

POLYXPRESS+: USING SOCIAL NETWORKING TO ENHANCE THE USER
EXPERIENCE OF AN INTERACTIVE LOCATION-BASED STORYTELLING
APPLICATION

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ABSTRACT

PolyXpress+: Using Social Networking to Enhance the User Experience of an Interactive Location-Based Storytelling Application

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There's no denying the ever increasing presence of social networking in our daily lives. Every day, people share what they are thinking, doing, and experiencing. But even more so, they check their favorite networks to see what the people in their lives are sharing. Social networking has become so prevalent that most applications incorporate it since it keeps users engaged and beckons them back to the application again and again.

PolyXpress is an interactive, location-based storytelling mobile application that functions as a platform for creating and experiencing stories. Written as a research project at California Polytechnic State University, it allows users to play through stories in real-world locations by using their smart phones. However, in an age of social networking, PolyXpress falls behind the curve, as it does not contain any social features.

The work in this thesis aims to test if adding social networking features to PolyXpress will increase user engagement by performing a usability study. The new social features allow users to participate in public forums about stories, message friends while playing stories, and view their friends' experiences within the app. The results of the study indicate that the overall user experience of PolyXpress was not increased by the social networking features; however, these features are desired and liked by the users. 70% of the experimental group enjoyed using the social features, while 30% remained indifferent. The problem is that the new features disrupted app satisfaction, as UI satisfaction decreased from 100% with the control group to 40% with the experimental group.

Keywords— social-networking, location-based, usability, engagement, mobile

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TABLE OF CONTENTS

	Page
LIST OF TABLES	ix
LIST OF FIGURES	x
CHAPTER	
1 Introduction	1
2 Background	3
2.1 PolyXpress Platform	3
2.1.1 Mobile Designer	4
2.1.2 Mobile Player	6
2.2 Technology	6
3 PolyXpress+ Feature Design	8
3.1 Socially Experiencing Stories	9
3.1.1 Chapter Comments	10
3.1.2 Page Messages	10
3.2 Sharing Story Experiences	13
4 Design Implementation	16
4.1 Location-Based Messaging	16
4.1.1 Message Notifications	18
4.2 Location-Based Comments	19
4.3 Friends and Nearby Feeds	20
5 Assessment	22
5.1 Testing Setup	22
5.2 Testing Methodology	25
5.2.1 Phase 1: App Click-Through Test	25
5.2.2 Story Play-Through Test	27
5.2.3 Testing Transcript	27
5.3 Test Results	29
5.4 Findings and Recommendations	35
6 Related Work	40

7	Conclusion	42
7.1	Future Work	43
	BIBLIOGRAPHY	45
	APPENDICES	
A	Background Questionnaire Form	48
B	Control Click-Through Task List	52
C	Experimental Click-Through Task List	53
D	Assessment Questionnaire for Control Group	54
E	Control Group Questionnaire Results	57
F	Assessment Questionnaire for Experimental Group	62
G	Experimental Group Questionnaire Results	67
H	Debrief Questions and Responses for Control Group	73
I	Debrief Questions and Responses for Experimental Group	76

LIST OF TABLES

Table		Page
4.1	The mongoose schematic for the Message database object.	19
4.2	The mongoose schematic for the Comment database object.	20
4.3	The mongoose schematic for the Feed database object.	21
5.1	The amount of seconds it took participants (P) of the control group to complete their tasks.	31
5.2	The amount of seconds it took participants (P) of the experimental group to complete their tasks.	32
5.3	The average amount of seconds it took the groups for each task compared to the expected time per task.	32

LIST OF FIGURES

Figure	Page
2.1 The PolyXpress mobile website.	4
2.2 A section of the new chapter form within the PolyXpress Mobile Designer.	5
2.3 A screenshot of the PolyXpress Player home view.	7
3.1 The PolyXpress+ Player home view.	9
3.2 An example of public chapter comments.	11
3.3 The UI flow of private page messaging.	12
3.4 A screenshot of the PolyXpress+ Player notification view.	13
3.5 An example of the friends and nearby feeds.	15
4.1 Sequence diagram for sending a message.	18
5.1 Experimental group's Facebook connections graph.	23
5.2 Test users age demographics.	24
5.3 The pass and fail percentages of the control tasks.	30
5.4 The pass and fail percentages of the experimental tasks.	30
5.5 The compiled results for the control questionnaire.	38
5.6 The compiled results for the experimental questionnaire.	39

Chapter 1

INTRODUCTION

Over the past decade, social networking sites (SNSs) have taken the world by storm and have transformed the way people communicate and interact. In , SixDegrees.com, the first recognizable social networking site, was launched [10]. This SNS simply allowed users to make profiles and connect to other users. The user could then view the chain of connections that linked him to any other user. SixDegrees.com was the first site to incorporate all three key features that define a web-based social networking site: the ability to (1) construct a public or semi-public profile, (2) connect with other users, and (3) view and traverse the connections made throughout the system [10]. The SNSs of today incorporate many features to differentiate themselves from other services and capture their unique target audience, such as LinkedIn's professional atmosphere and MySpace's focus on music. Today's most popular SNSs include Facebook and Twitter, with 1 billion and 500 million active users, respectfully [17][20]. With that many users on social networks, it's no wonder that the main use of social networks is to keep in touch with friends, or to develop "social connections" [8].

Although online social networking is still popular, the shift to mobile browsing cannot be ignored as more people switch to using smart phones. People are spending less time on their home computers browsing the web and more time on their mobile devices. Many social networking sites have responded to this transition by creating mobile applications. For instance, by January 2013, Facebook, the world's largest social networking site, had more mobile daily active users than desktop daily active users [12].

As the presence of social networking on mobile phones continues to grow, more mobile applications are trying to incorporate social networking features with the hope

of enhancing their user's experience. One such instance of this is with mobile gaming applications. Several studies have looked at mobile games that have social features and have found that social interactions enhance the game play experience [14][18]. PolyXpress is an interactive, location-based storytelling mobile application that has engaging features similar to games. It is a platform for creating and experiencing interactive stories. Instead of reading a story, users live it. As users play through a story, they trigger events at real-world locations in which they must interact with the environment around them. However, PolyXpress lacks social networking functionality. PolyXpress+ (pronounced PolyXpress plus) aims to enhance the user experience of PolyXpress by adding common social networking features, such as connecting with friends, communicating with friends in the app, and sharing unique experiences. The purpose of this thesis is to prove that the social networking features of PolyXpress+ will increase the user engagement of the app in its current state.

Chapter 2

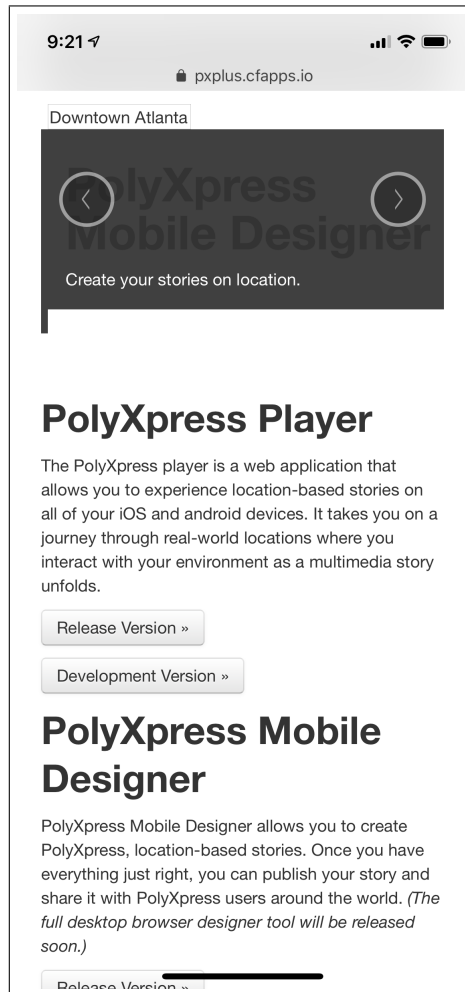
BACKGROUND

Researching mobile, location-based storytelling is by no means a new line of research. In fact, its been going on long before mobile devices and the Internet became widely popular. It started as early as 1997 at Georgia Tech when Cyberguide, a mobile context-aware tour guide was created [5]. This was before smart phones and social networks, yet with this prototype system, users were guided through a college center and given information about the center depending on their exact location [5]. Even though this topic has been researched for over a decade now, there are always new facets to explore as technology continues to advance. PolyXpress furthers the study of using mobile devices as a means of relating context-aware information.

2.1 PolyXpress Platform

The PolyXpress platform is a mobile web app for creating and experiencing interactive stories that are based on real-world locations. The platform is made up of three components: an authoring tool for creating the stories, a story player for playing the stories, and a cloud service for publishing stories [1]. The platform was developed by Dr. Michael Haungs as a research initiative for the Liberal Arts and Engineering Program at California Polytechnic State University, San Luis Obispo. The PolyXpress platform can be accessed by entering “<https://polyxpress.cfapps.io>” into any mobile browser such as Safari or Google Chrome. Figure 2.1 depicts the PolyXpress home page. This is where users can launch the different components of PolyXpress: the player, the mobile designer, and the point finder.

Figure 2.1: The PolyXpress mobile website.



2.1.1 Mobile Designer

The PolyXpress Mobile Designer enables users to write creative stories and publish them for other PolyXpress users to experience. To access the Mobile Designer, click the “Release Version” button under the PolyXpress Mobile Designer section of the platform’s landing page shown in Figure 2.1. After authenticating with either Facebook, Google, or Twitter, the user can start writing stories. The basic format of a story is as follows: stories can have one or more chapters, chapters can have one or more pages, and pages can have one or more assets. Assets can be any form of multi-

media, such as text, images, videos, or audio. When creating a story, the user creates all pages first by filling out all the fields of the Page Creation form. Next, the user can create the story's chapters. When creating a chapter, the user must include all the corresponding pages. Figure 2.2 contains a sample of the Chapter Creation form. Finally the user can create the story by filling out the story form and marking which chapters to include. The author can then test out their new story before publishing it to the PolyXpress library. It is up to the author to use these tools to create engaging content that relates to the real-world locations in which the story takes place.

Figure 2.2: A section of the new chapter form within the PolyXpress Mobile Designer.

The screenshot shows a mobile application interface for creating a new chapter. The title bar at the top reads "PolyXpress Desi...". The form is divided into several sections. The first section is labeled "Title:" and contains a text input field. The second section is labeled "Teaser:" and contains a text input field. The third section is labeled "Overview:" and contains a rich text editor with a toolbar showing options like "Normal", "Bold", "Italic", "Underline", "List", "Link", "Image", "Code", and "Undo". Below the "Overview:" section is an "Image:" section with a text input field containing the placeholder "Use a url.". At the bottom of the form is a section titled "Geographic Location Information" and two buttons: "Save" and "Cancel".

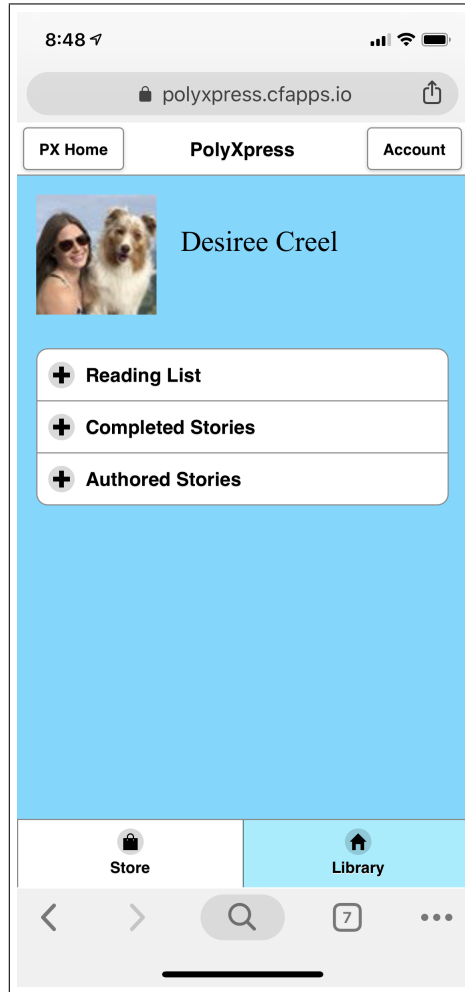
2.1.2 Mobile Player

The PolyXpress Player component is responsible for the playback of the stories created with the Mobile Designer. Users can launch the player by clicking the “Release Version” button under the PolyXpress Player section of the platform’s main page shown in Figure 2.1. To use the player, the user must authenticate with either their Facebook, Google, or Twitter login credentials. After authenticating, the user will see the player home view that contains their story lists. There are three lists as depicted in Figure 2.3, one for stories that have yet to be played, one for finished stories, and one for authored stories. The player also contains a library where users can add new stories to their reading list. To play a story, the user clicks on a story from one of their lists. Once the story is started, the user must use the maps within the app to find the chapter and page locations to experience the story.

2.2 Technology

In order to make these components possible, the PolyXpress platform was built using several different technologies. The whole platform was coded in Javascript and HTML, and runs on Node.js. It uses Inject, Bower, and CommonJS frameworks to manage all the project dependencies and to organize the modules within the project. The user interface was built using JQuery Mobile and styled with Bootstrap and custom CSS. The data models used within PolyXpress conform to a Mongoose schema and are stored in a MongoDB database. PolyXpress uses the location-based services of the device, along with the Google Maps API to handle positioning the user on the map relative to the story locations. The platform was deployed using Pivotal Web Services (<https://pivotal.io/>). Together, these frameworks and libraries make PolyXpress compatible with multiple browsers from devices with different operating systems, such as Android and iOS.

Figure 2.3: A screenshot of the PolyXpress Player home view.



The PolyXpress platform allows users to login with three different social networking credentials: Google, Twitter, and Facebook. However, in order to keep the scope of the project within a manageable time frame, the features of PolyXpress+ only use a single social network. Facebook was chosen as the main social network since it's one of the world's most popular SNSs. Authenticating with Google or Twitter was removed from PolyXpress+. As with any social network, it's important to have secure login. PolyXpress uses Passport, authentication middleware for Node.js, to handle user login with Facebook [2]. PolyXpress+ also uses a node module called *fbgraph* to retrieve information about the authenticated user from the Facebook Graph API [3].

Chapter 3

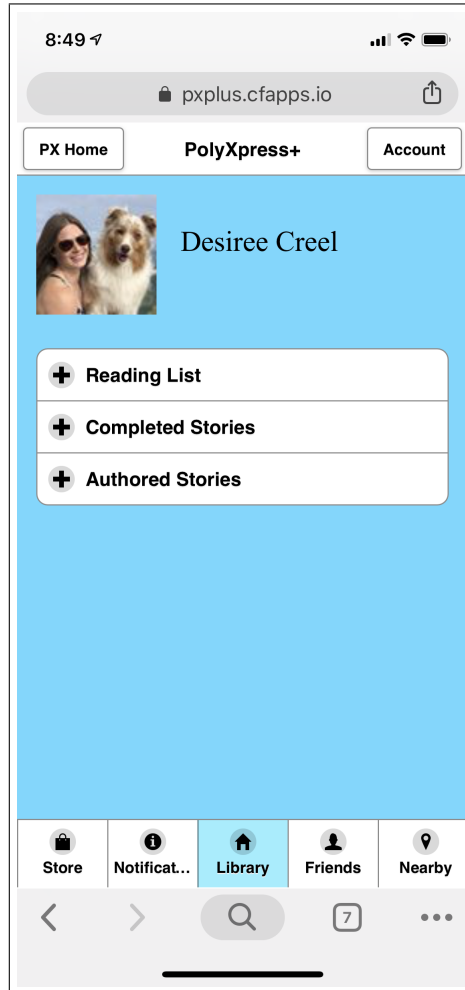
POLYXPRESS+ FEATURE DESIGN

This chapter details the enhanced user experience design of the PolyXpress+ Player. The PolyXpress+ Player was created by incorporating social networking features into the original PolyXpress Player discussed in Chapter 2. Some of the most important features of today's social networking include connecting, communicating, and sharing with friends and people nearby. PolyXpress+ allows users to partake in these top features by connecting with Facebook and adding social interactions with Facebook friends throughout the player application.

In order to add social networking into PolyXpress, the users need to give permission to access their basic Facebook data, such as their name, user id, profile picture, and friends list. This is achieved the first time the user logs into the PolyXpress+ Player at <https://pxplus.cfapps.io/PolyXpress/Player/pePlayer.html>. They will be prompted to login to the player with their Facebook account information and give PolyXpress+ permission to use the data. Once logged in, the user is presented with their PolyXpress+ profile page shown in 3.1. The profile contains information taken from their Facebook account, such as their name and profile picture. Similar to the original PolyXpress home page, the profile page contains three lists of stories that represent the user's library - categorized as unread stories (reading list), completed stories, and stories authored by the user.

The bottom of the page contains a navigation bar that transitions the user between different views of the app. The leftmost button on the toolbar with a store icon takes the user to the PolyXpress+ store. This is where the user can search using keywords for stories to add to their reading list. The user can also easily view recent editions to the store. The second-leftmost button takes the user to their message notifications.

Figure 3.1: The PolyXpress+ Player home view.



The “Friends” button takes the user to their friends feed, while the “Nearby” button shows the user nearby PolyXpress+ activity. These new features will be thoroughly explained later this chapter.

3.1 Socially Experiencing Stories

Communicating throughout the story playback is one major social networking feature that has been added to PolyXpress+. This feature was added with the hopes of making the stories more engaging for users. In order to use this feature, the user

must play a story by selecting one from a story list on their profile page. The story will begin with an overview of the story. After reading the overview, the user clicks the “Continue...” button to view the story’s chapters. The chapters screen displays a map that pinpoints the chapters’ locations in the real world. The user’s current location is also tracked on the map. Once the user is in range of a chapter, a pop-up dialog appears, notifying the user that a chapter is available to view. The user must click on the chapter icon on the map to open the chapter and display its summary.

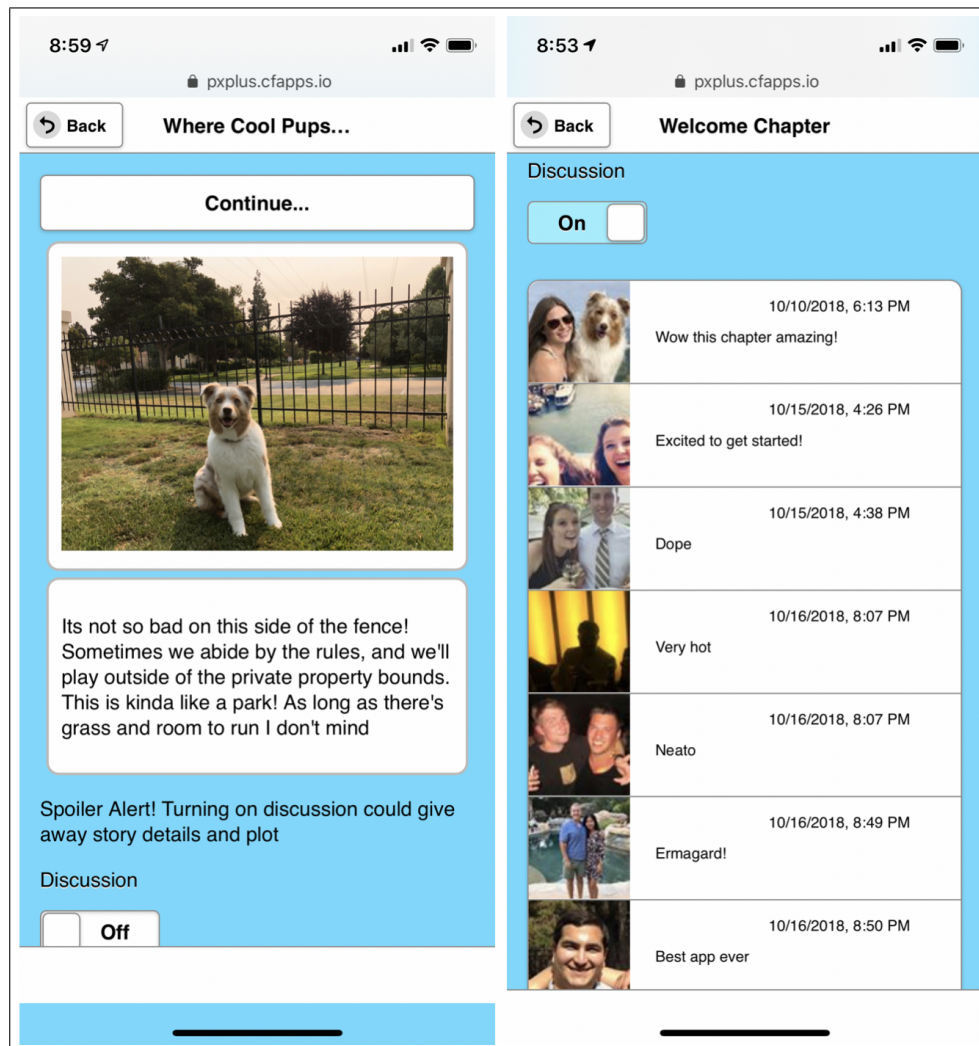
3.1.1 Chapter Comments

The first way users can socially experience stories is with chapter comments. Below the chapter summary is an area for the user to leave public comments about the chapter as shown in Figure 3.2. For a comment to be public, PolyXpress+ users do not have to be Facebook friends to see each other’s comments. If a user leaves a comment, any PolyXpress+ user can see it when they visit that chapter. This is similar to public forums on the Internet. By default, the comment thread is turned off and the comments are hidden because they may reveal facts or expose plot that could potentially spoil the story. When the user is ready to read the comments, they can manually turn on the thread using the switch in Figure 3.2. Once the comments are visible, the user may leave comments for others to see, as well.

3.1.2 Page Messages

Each chapter contains one or more pages, which are pieces of the chapter for the user to unlock. Similar to the chapters, once a page is in physical range, a pop-up dialog notifies the user that the page is available. The user can then see the page location on the map. The page may contain different multimedia content, such as text, photos, audio, or video. The content may have the user interact with the

Figure 3.2: An example of public chapter comments.



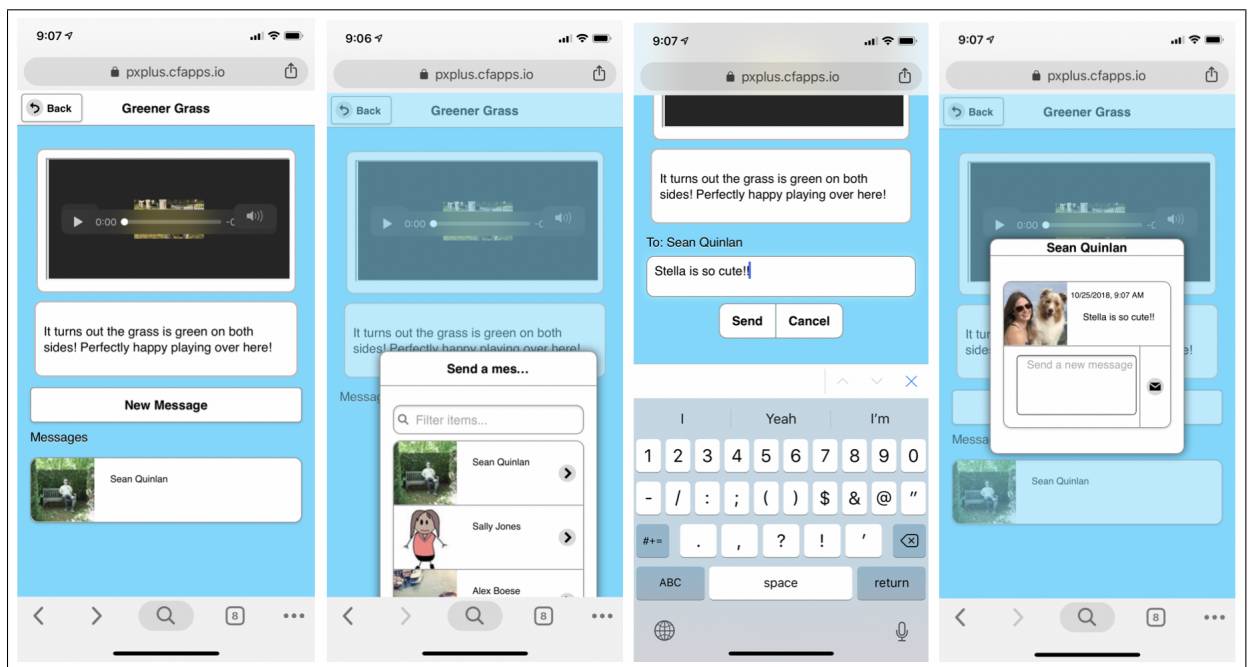
surrounding environment to enhance the story.

The PolyXpress+ Player allows users to communicate privately by messaging each other at the page locations. The user can send his or her Facebook friends that use PolyXpress+ a message at each page by clicking the “Send Message” button located at the bottom of the page, shown in Figure 3.3. Clicking this button opens up a pop-up dialog that displays a list of friends to message. The user can search through the list for quick friend retrieval, then select the person to message. These messages are private and are not visible by anyone except the two users involved in the message

thread.

Messages were designed into PolyXpress+ to give users a direct, personal connection with their friends in the app. They were made private so that the users could engage on a more personal level, without the fear that other people would judge them. Messages were placed within the page views in order to drive users through the story. The idea that a friend left a message at a specific page may give the user more motivation to continue through a story to unlock the messages.

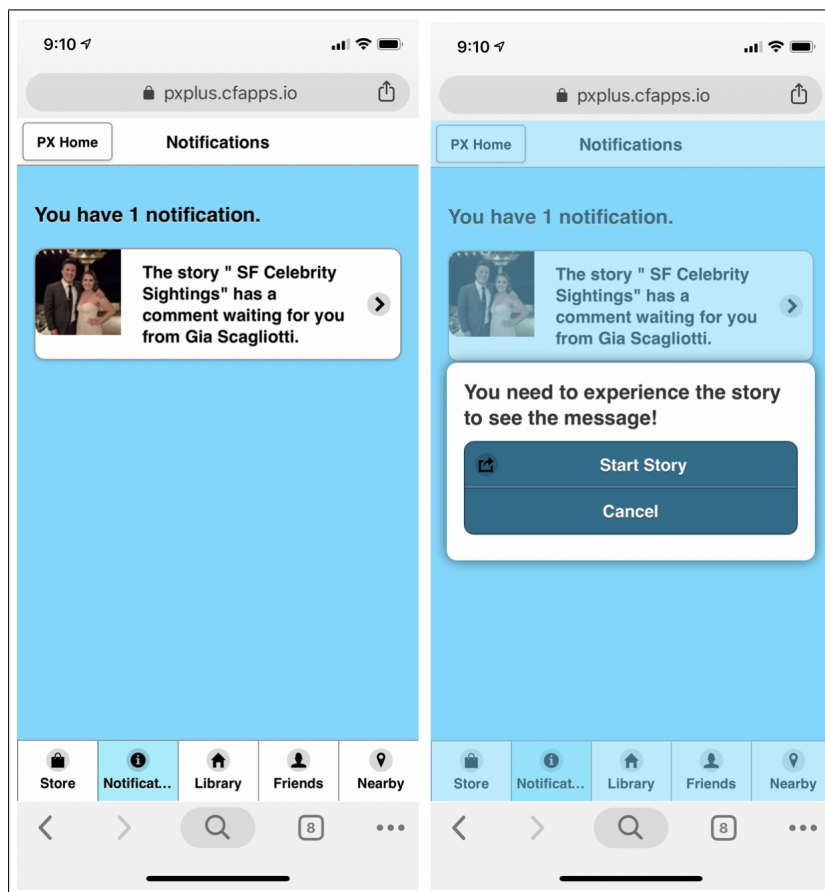
Figure 3.3: The UI flow of private page messaging.



When a user is messaged, they will see a notification in their notification view. The “Notification” button on the navigation bar takes the user to the notification view, shown in Figure 3.4. In this view, the user is notified of any messages that their friends have left for them at specific story pages. To view the message, the user must click on the notification. If the user has previously viewed the page where the message was left, they can directly read the message. Otherwise, the user is informed

of the story and chapter in which the message is located, and is given the option to start or add the story to their reading list. In order to encourage story consumption, users are notified that a message awaits them within the story, but they can only view the message once they reach the location. Both scenarios are shown in Figure 3.4. Each feed item can be clicked-on, allowing the user to add the story in the selected item to his or her library to experience at a later time.

Figure 3.4: A screenshot of the PolyXpress+ Player notification view.



3.2 Sharing Story Experiences

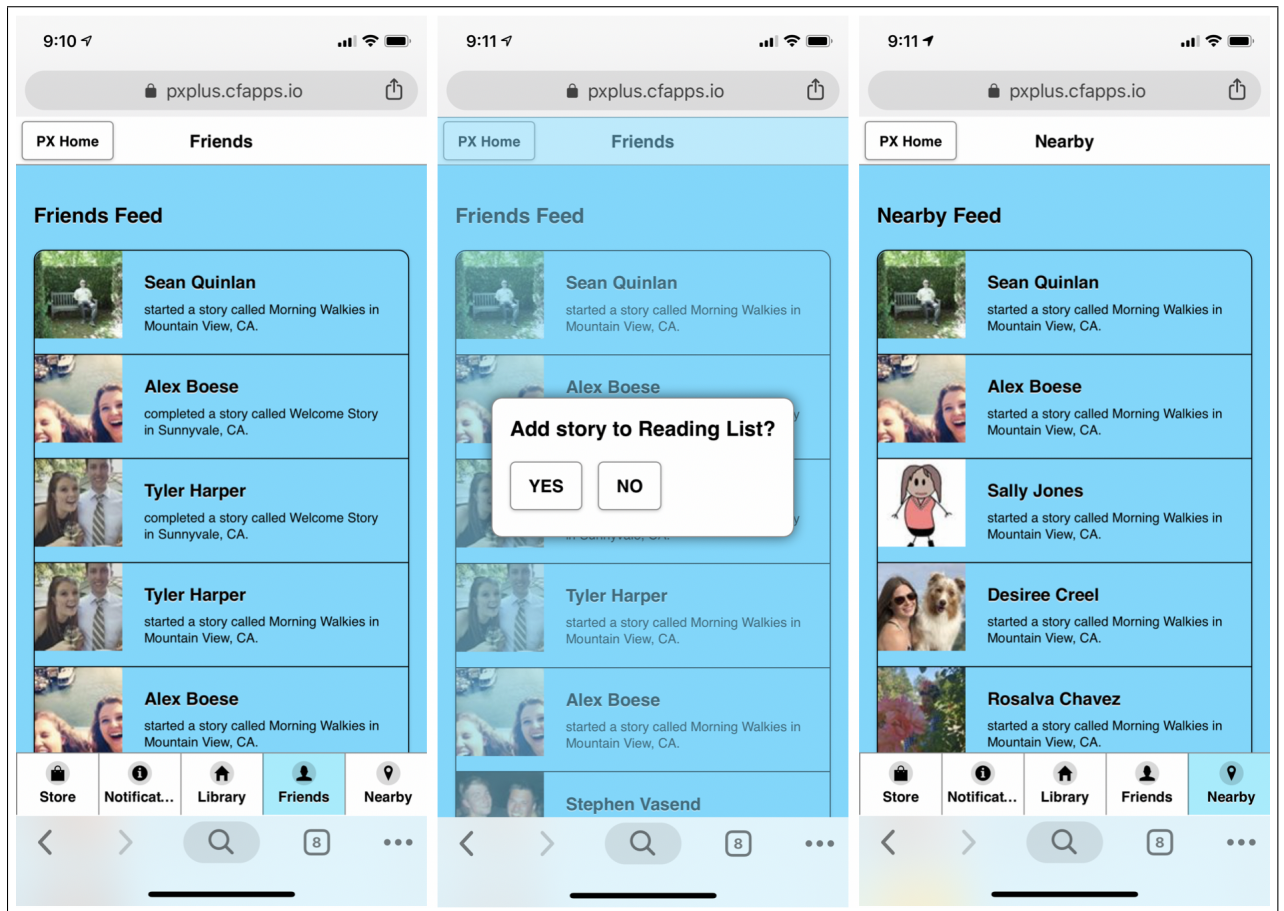
As mentioned previously, an important factor for social networking is viewing other users' activity. Feeds allow users to see what friends or nearby people are doing.

They help users discover more content within the app. In the case of PolyXpress+, users can view PolyXpress+ story activity through two different feeds: friends and nearby. The two rightmost buttons of the navigation bar, containing a people icon and a world icon, represent the Friends feed view and Nearby feed view, respectively. A PolyXpress+ feed item is created when a user starts, completes, or authors a story. The feed item shows the user profile and gives a brief description of the activity.

The Nearby feed view, shown in Figure 3.5, displays a feed of stories that have been experienced nearby the user's current location. The users in this feed are not necessarily Facebook friends with the current active user, but rather are other users of the PolyXpress+ Platform. The purpose of this feed is for users to easily discover local stories.

The Friends feed view, shown in Figure 3.5, shows a feed of the user's Facebook friends' PolyXpress+ activity. It shows the current stories that the friends are experiencing, regardless of how close they are to the user's current location. This lets the users discover stories that may interest them since their friends have showed interest in them.

Figure 3.5: An example of the friends and nearby feeds.



Chapter 4

DESIGN IMPLEMENTATION

This chapter details the steps taken to implement the PolyXpress+ social networking features. Each section describes the client-side and the server-side implementations of the given feature.

4.1 Location-Based Messaging

In order to implement the location-based messaging feature, the page view was altered. A combination of jQuery mobile buttons, pop-up dialogs, and listviews were integrated into the UI. There are several client/server interactions that are necessary for the messaging feature, as shown by the sequence diagram in Figure 4.1. To start the process of messaging a friend, a new button was added to the page's view.

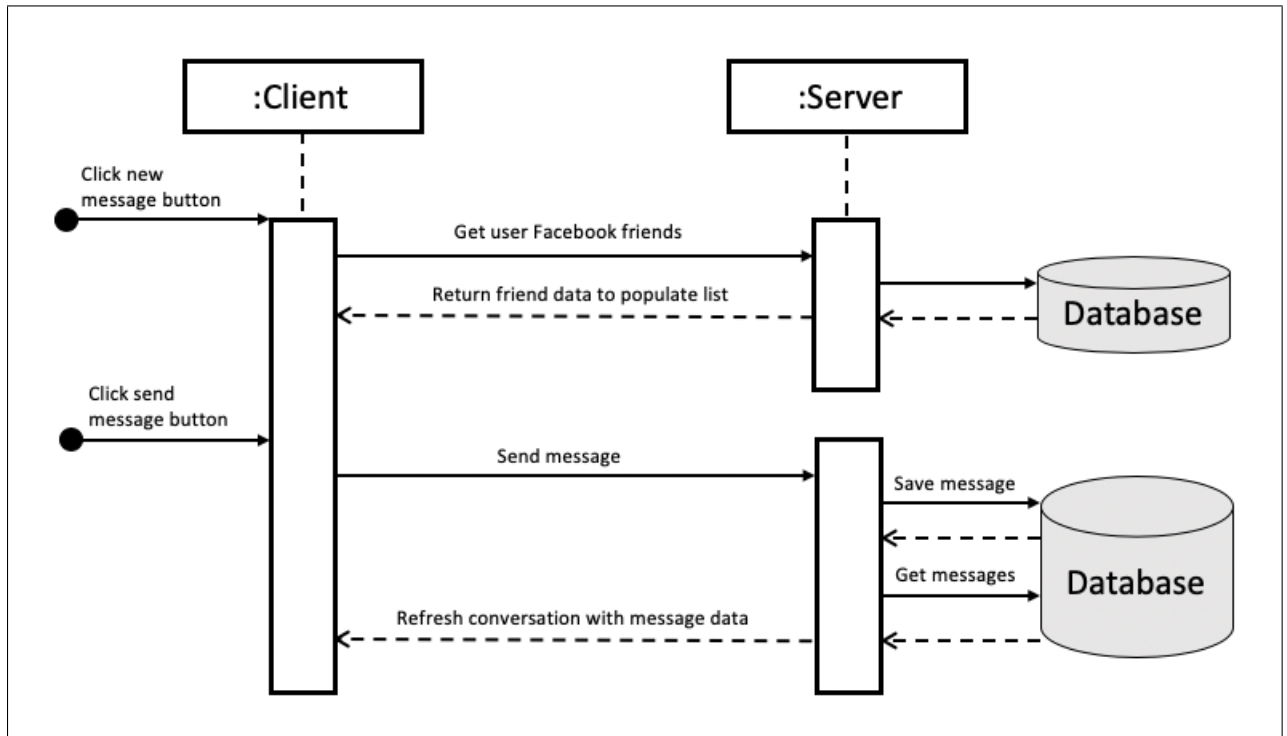
When the user clicks the “New Message” button, they expect to see a pop-up dialog containing a list of Facebook friends. To populate the dialog, the client needs the user name and profile picture URL for each Facebook friend. However, the client only has access to the User object that contains a list of Facebook friend ids. The client has to call the server to retrieve the information needed to display the friend list items in a pop-up dialog, shown in Figure 3.3. To get the extra information, the client calls a server method called `getUserFacebookFriends` and passes the user's list of Facebook friend ids. This method uses a restful web API that queries the database for User models that have Facebook id values that match those in the passed-in list. Once the query is finished, it calls the display callback method, which, in this case, is the client's `populateFriendsPopup` method, and passes it the resulting list of User objects. Now that the client has the list of User models, the `populateFriendsPopup`

method can create the list-items to display the user’s Facebook friends, and the user can select a friend to message.

Selecting a friend hides the chooseFriendsPopup dialog and displays an area for creating the message, shown in Figure 3.3. After writing the message the user sends it with the “Send Message” button, or cancels it with the “Cancel” button. When the “Send Message” button is clicked, the server is called to save the message in the database; this is equivalent to sending the message to the recipient. After the message is sent, the “New Message” area is closed and the message listview is refreshed. The message listview contains all the conversations of the user at the specific page. The conversations are shown by the recipient’s user profile picture and name, as shown in Figure 3.3. When the user clicks on an item from this list, a pop-up listview is displayed that contains all the messages between the user and recipient at this page. The last item of the conversation pop-up contains a text area and a send button to enable the user to continue the conversation, as shown in Figure 3.3.

Every time the user sends a message, a new Message object is created and saved in the database. The Message object follows a mongoose schematic that contains the fields shown in Table 4.1. The Message object contains the actual text message as written by the sender. It also contains the object id of the sending and receiving users. These are used when displaying the conversations, as well as displaying a user’s message notifications. The Message object must also contain the object ids for the story, chapter, and page in which the message was sent. These ids play a role when displaying a user’s conversation list and whether or not they can view the message from the notification view. The seen field is used to determine if the message has been viewed by the recipient. It’s used to determine if a notification should be created for this message when the notification view is refreshed. The creation field represents the date in which the message was created and is used when displaying the message as part of a conversation.

Figure 4.1: Sequence diagram for sending a message.



When the app needs to display the list of conversations at an event, the database is queried for all Message objects with the current event id and the receiver or sender id matching the current logged in user. The resulting Message objects are sorted by receiver into conversations and displayed to the user via a callback function.

4.1.1 Message Notifications

The Message object is also used to display message notifications. When the user navigates to the notification view, the client controller calls the server to get the notifications for the logged in user. The server function routes to the database and queries for all Message objects in which the receiver matches the id of the current user and that have a seen value of false. For notifications, the app will only show messages that have not been viewed by the user. The server calls the display callback function to

Table 4.1: The mongoose schematic for the Message database object.

Name	Value	Description
Text	String	The textual message that the user is sending.
Receiver	Schema.Types.ObjectId	The object id of the user that is receiving the message.
Sender	Schema.Types.ObjectId	The object id of the user that is sending the message.
Event	Schema.Types.ObjectId	The object id of the event where the message occurred.
Chapter	Schema.Types.ObjectId	The object id of the chapter in which the message occurred.
Story	Schema.Types.ObjectId	The object id of the story in which the message occurred.
Seen	Boolean	Represents if the message has been viewed by the receiver.
Creation	Date	The date in which the message was created.

populate the notification view with the resulting messages. Each notification is bound with one of the following two onClick functions: (1) canViewMessage: loads the story, chapter, and page necessary for viewing the comment, or (2) cannotViewMessage: provides the user with the option to start the story or add it to their reading list.

4.2 Location-Based Comments

Location-based comments were added into PolyXpress+ by augmenting the chapter overview view with a few new UI elements. A jQuery mobile slider widget was added to toggle the visibility of the comments and the “Leave Comment” button. The comments are displayed using a jQuery mobile listview. When the user switches the slider to “on”, the comment listview and button become visible, and the listview must be populated. To populate the listview, the client asks the server for all comments that belong to the given chapter. The server routes this request to the database, which processes the query. The database returns the list of Comment model objects, described in Table 4.2, to the server. Finally, the server calls the display callback function that uses the data to create listview items to populate the comment listview.

The `populateChapterComments` function uses the information from each `Comment` model to create a list view item. The user id of the `Comment` model contains the Facebook profile picture URL that gets displayed in the list item as a thumbnail. To the right of the thumbnail, the text is displayed along with the date that the comment was created. Each item created is chronologically appended to the listview. The last item in the listview contains a text area for users to write their next comment. When the “Leave Comment” button is clicked, the client requests that the server store a new comment in the database. The text for the comment is taken from the text area within the comment listview and the text area is cleared out for the next new comment.

Table 4.2: The mongoose schematic for the `Comment` database object.

Name	Value	Description
User	Schema.Types.ObjectId	The object id of the user that left the comment.
Chapter	Schema.Types.ObjectId	The object id of the chapter that the comment was left in.
Text	String	The text of the comment.
Created	Date	The date the comment was created.

4.3 Friends and Nearby Feeds

The final new feature that was implemented is the PolyXpress+ activity feeds: the friends and nearby feeds. A feed item is created and stored in the database when a user does one of the following actions: (1) starts a story, (2) finishes the playback of a story, or (3) publishes a story using the authoring tool. The feed item is stored in the database using the Mongoose schematic described in Table 4.3. The listview items are created in the same manner for both feeds; the only difference in their creation is the route used by the server to query the database. For the Friends feed, the server queries the database with the current user’s Facebook id. This query first finds a

User model with the matching Facebook id. It then uses the User model to get the list of Facebook friends and finds all Feed models that have a matching Facebook id of the user's Facebook friends. To get the Feed models for the Nearby feed, the server queries the database with the user's current latitude and longitude coordinates. This query searches for all Feed models that are within a specified distance from the given latitude and longitude by comparing these values against the location field of the Feed model.

Once the client has the Feed models, it can create list items to populate the feed listview. The list item elements are composed of an image element, heading element, and paragraph element. The image element embeds the user's Facebook id into a Facebook open graph URL to retrieve the Facebook profile image. The heading element is used with the user's name. The paragraph element contains a string that's constructed using the Feed model's action and city fields that states the user's activity. An onClick action is bound to each item that allows the user to add the story to their reading list if they click on the item in the feed. A populated Nearby feed and a Friends feed are shown in Figure 3.5.

Table 4.3: The mongoose schematic for the Feed database object.

Name	Value	Description
User	Schema.Types.ObjectId	The object id of the user that the feed object belongs to.
Story	Schema.Types.ObjectId	The object id of the story that the feed object is about.
FacebookId	String	The Facebook id of the user that the feed object belongs to.
Action	String	Represents the type of action of the feed: started, completed, or authored.
City	String	Represents the city in which the feed object takes place.
Location	Number Array	Two numbers that represent the latitude and longitude of the feed's location.
Created	Date	The date the feed object was created.

Chapter 5

ASSESSMENT

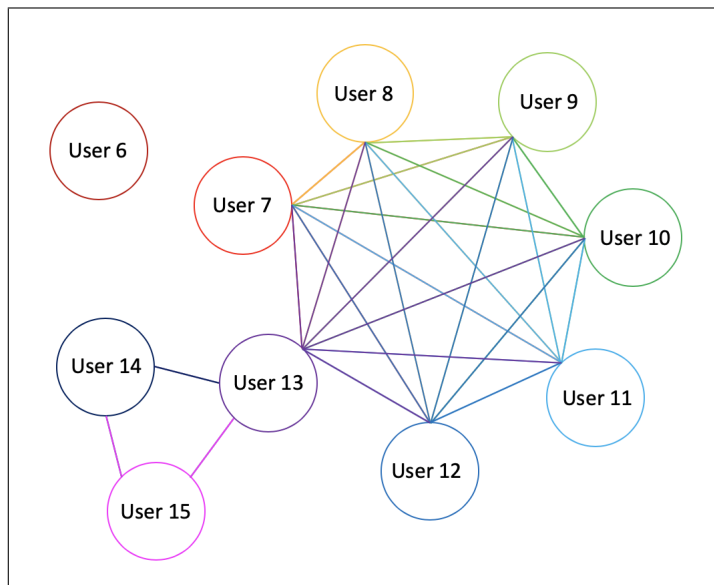
This chapter explains the process by which the social features described in Chapter 3 were assessed for their effect on user engagement of PolyXpress. The objective of the usability test is to see if the new social networking features enhance the user experience of the PolyXpress Player application. To test this hypothesis, both the PolyXpress Player and the PolyXpress+ Player need to be evaluated for usability. The PolyXpress Player will function as the control app and a base to compare the results to the experimental PolyXpress+ Player app.

5.1 Testing Setup

This section details the setup that was necessary for the assessment process. A total of 15 test users were selected and split into a control group and an experimental group. According to Nielson's Theory of Usability, having more than five testers will not expose more usability problems, which is why five participants were put in the control group [11]. Ten users were assigned to the experimental group because to test social networking features, it's important that the test users share real connections on Facebook. The social connections between the users are shown in Figure 5.1. This will give the test users a more realistic representation of the PolyXpress+ app, allowing the most accurate feedback after testing. A participation consent form was created to get the testers' consent to be apart of the study, as well as to gather demographic information about the participants. The age demographic of the participants, gathered from the forms, ranges from 26 to 39 as shown in Figure 5.2. This is a good age range for the study since 88% of adults in the U.S. between the ages 18

and 29 and 78% of adults in the U.S. ages 30 and 49 use social networks [19].

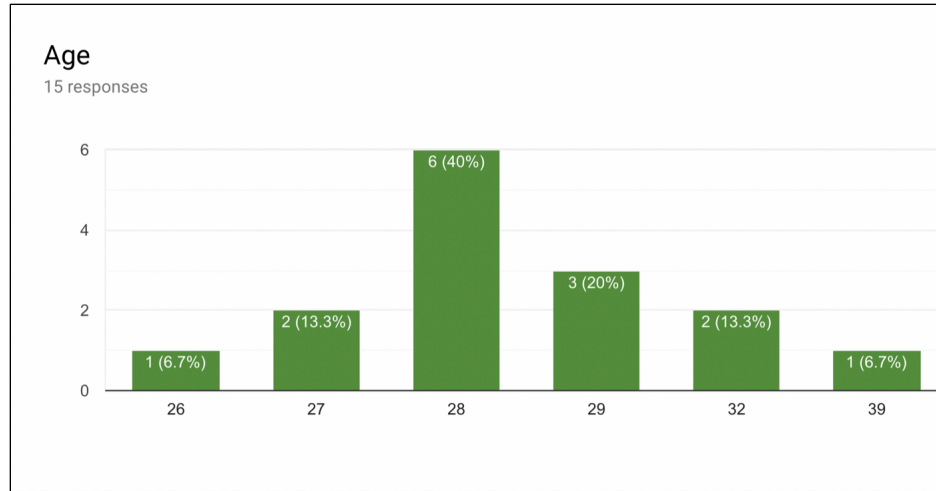
Figure 5.1: Experimental group’s Facebook connections graph.



The consent forms also revealed that 46% of the testers use iPhones and 54% use Android phones. The testers reported that for their web browsers, 67% use Chrome and 33% use Safari. This is important so that all test users could take the test using their own devices. With their own phones, they felt more comfortable and natural during the test. Lastly, the form asked the testers if they use Facebook, to which two participants responded *no*. For testing purposes, they were given a test Facebook account to use when they needed to log into the app for testing.

To prepare for the first phase of testing, the click-through test, a self-guided PolyXpress tutorial story called “Welcome Story” was written. This story helps the test participants get familiar with using the player app. Two versions of the story were created, one for the control group and one for the experimental group. Each version contains one chapter that explains how chapters work, and one page that details what a page is. The experimental version was modified to include more information about the social networking features. The chapter contains instructions on to how to leave

Figure 5.2: Test users age demographics.



a comment, and explains the chapter discussion feature. The page describes how the messaging feature works. After playing this story, the participants should be ready to play a real story during the second phase of testing, and to understand how to navigate smoothly through the app.

For the second phase of testing, the story-playback test, several stories were prepared for the users to experience. These stories were written to take place at convenient locations for the participants, locations that they visited often: the Mission District in San Francisco, the author's neighborhood in Mountain View, the Moffett Towers Gym in Sunnyvale, and the Smash Gym in Sunnyvale. Each story contains at least two chapters, with at least one page with multiple assets for the tester to experience.

A number of documents were prepared for the testing phases and evaluations, as well. Task lists were created as part of the click-through testing. The task lists were simply typed out on a word document to hand to participants during the test as shown in Appendices B and C. Post-testing questionnaires were created for each group using Google Forms and are shown in Appendices D and F. These questionnaires posed

statements based on the Likhart scale about the usability and the social networking features of PolyXpress. Lastly, four debrief free-form interview questions were created to give the testers a chance to openly talk about their experience using the app. This will capture any highlights or concerns of the app that the questionnaires or task list did not cover.

There was minimal physical equipment used for testing. Each test participant's phone was required. The test moderator used her own phone to record time, and took notes during the click-through test and debrief with her laptop.

5.2 Testing Methodology

This section describes the methodology in which the hypothesis was tested. The testing process was broken up into two major parts: app click-through and story walk-through. Each test plays a different role in gathering data to support or oppose the thesis hypothesis. Each participant went through the testing process in the following manner: (1) welcomed and thanked for participating, given a brief background of the testing process and app in question, and then signed the consent form, (2) proceeded with the app click-through test, (3) completed the story walk-through test, (4) answered the post-test questionnaire, and (5) concluded the test process by answering questions in the debrief interview.

5.2.1 Phase 1: App Click-Through Test

The purpose of the app click-through test is to get metrics on how long it takes the test participants to perform specific tasks with the app. The tasks were predefined and printed out for the participants before their testing appointments. The tasks were designed to get the test participants to attempt each feature of the app that is important for the hypothesis. The moderator timed each task and took notes on

how the participants worked their way through the tasks. Before taking this test, participants had little to no exposure with the PolyXpress app. This was important to see how they used the app with minimal guidance and instruction.

Two sets of tasks were designed: one for the original PolyXpress Player and one for the PolyXpress+ Player with social networking features. The control task list is shown in Appendix B. These tasks require the test participants to log into the app, add “Welcome Story” to their reading list, and play “Welcome Story.” These three tasks capture the basic functionality of the PolyXpress Player.

The experimental task list is shown in Appendix C. It is comprised of seven tasks in order to cover all the important functionality of PolyXpress+. The first task is to simply log in to the app. The second task requires the user to add “Welcome Story” to their reading list. The first two tasks are similar to the control group. The third task, however, not only requires the user to start reading “Welcome Story,” but to leave a comment in the chapter. The importance of this task is to get the user to understand how to leave a comment in a chapter - the first social feature. In order to do this, they need to navigate to the chapter, scroll to the bottom of the chapter’s view, and turn on the discussion. Then, they can leave a comment. The fourth task is to send a message to a friend while viewing the “Welcome Story.” This requires that the user play the story to a page. In the page, they will see a Send Message button. It’s important that this task be fluid for the user because messages are a key part of the social networking functionality, as they are to encourage users to play the stories. The fifth task requires the user to read a PolyXpress+ notification. This task requires them to navigate out of story playback and back to the app’s home screen. From the home screen, they should see the Notification tab in the navigation bar. The sixth task aims to make the user use the Nearby Feed to find a story that’s near their current location. The seventh and final task asks them to find a story that a friend has played, with the hopes that they use the Friends Feed. By completing all

these tasks, the participant will have used each new social feature of the PolyXpress+ Player.

5.2.2 Story Play-Through Test

The purpose of the story play-through test is to observe how people use PolyXpress apps in real life situations. Since it's a location-based app, it's best tested in the real world. For each test run, the tester added the nearest story to their library. The moderator started the timer and accompanied them through the duration of the story. During the session, the moderator took notes about their behavior using the app or any questions/comments they had during the session.

After the participants finished playing the story, they were asked to complete the questionnaire appropriate to their group, as shown in Appendices D and F. Finally, the participants answered some free-form questions as a debrief. This gave them a chance to leave open-ended feedback about the app they tested, which will be used as insight and corroboration to their questionnaire results. Their responses were typed out during the interview to be referenced to later.

5.2.3 Testing Transcript

This section details the transcript in which each testing session was conducted.

Moderator: Thank you for participating in my testing. Before we get started, I need you to fill out a background questionnaire and consent form. I also need you to sign into Facebook and to confirm your testing role for the PolyXpress+ Facebook app.

*** Participant fills out the questionnaire sent to their email account. Participant logs into Facebook to confirm testing role (if they did not already do so). ***

Moderator: Once again, thanks for participating in my testing. As some background, my thesis is about an app called PolyXpress. It's a location-based, story-telling mobile web app that my advisor wrote at Cal Poly. With the app, you can write stories that take place in real world locations, and have other users of the app play your stories. I've created a couple test stories that you'll get to play, which will give you an idea of how the app works. The first part of the testing is a click-through test in which you'll complete a list of tasks by clicking through the app. The second part of the testing is actually playing a story by walking to the story's location. Then, we'll end with a survey and some debrief questions. For the survey and questions, please remember to give honest, unbiased answers. My thesis aims to analyze the app in its current state. Any questions?

*** Participant may ask questions. ***

Moderator: Okay, so before we get started, let's make sure the location-services feature is enabled for your mobile web browser.

*** Participant checks that location services is enabled on their phone. ***

Moderator: Great, now we will begin the click-through test. Please complete the following list of tasks while using the PolyXpress+ app.

*** The participant is given the task list from Appendix C if they are a part of the experimental group or the task list from Appendix B if they are in the control group. The participant completes the tasks, while the moderator observes, takes notes, records times, and helps the participant as needed. ***

Moderator: Thanks for completing the click-through testing. Now, we'll begin the story testing. Please add a story to your library and begin the story.

*** The participant is shown what story to select, depending on their testing location. They start playing the story. The moderator follows the participant as they play*

*the story to observe, take notes, record the time, and help with the app as needed. ***

Moderator: Now that you’ve completed the story test, we will end with some questions. First, please fill out the questionnaire that I just emailed to you.

*** The participant fills out the survey from Appendix F if they are a part of the experimental group. If they are in the control group, they fill out the survey from Appendix D. ***

Moderator: Lastly, we’ll finish up with with some free-form debrief questions. I will ask you a question and I’ll be typing your response while you speak. Feel free to think about it and answer honestly.

*** The moderator asks the participant the questions from Appendix I if they are in the experimental group. If the participant is in the control group, then the moderator asks them the questions from Appendix H. The moderator records their responses for later analysis. ***

Moderator: This concludes the test. Thanks again for participating!

5.3 Test Results

The data gathered from the click-through testing gives insight into the ease of which the user navigates the UI. Each task of the click-through testing was assigned a pass or fail after the user attempted the task. A pass signals that the user completed the task without much guidance. The task was marked as failed if the user was unable to complete the task due to bugs with the app, user error, or need a lot of guidance. After compiling the pass and fails from each groups’ tasks, the control group had an 87% success rate and 13% failure rate, while the experimental group had an 81% success rate and 19% failure rate. These rates are presented in Figures 5.3 and 5.4.

Each task attempt was also timed, and the results are shown in Table 5.1 for the

Figure 5.3: The pass and fail percentages of the control tasks.

Tasks	User 1	User 2	User 3	User 4	User 5	Pass %	Fail %
1) Login	P	P	P	P	P	100	0
2) Add story	P	P	P	P	F	80	20
3) Play story	P	P	P	P	F	80	20

control group and Table 5.2 for the experimental group. Logging into the app was the first task for both groups. The majority of the users took a lot longer than expected to complete the sign-in task. During the test, it was noted that most of users did not use Facebook regularly in their mobile browsers, so they had to try to remember their passwords (a pain point for many) and then login to Facebook. Then, they could finally use Facebook to login to the PolyXpress app. The second task was also the same for both groups; the experimental group took 18 seconds while the control group took 16.4 seconds. The majority of the participants easily clicked on the store as their first approach; however, several clicked on the reading list first. The rest of the task lists differed per group.

Figure 5.4: The pass and fail percentages of the experimental tasks.

Tasks	User 6	User 7	User 8	User 9	User 10	User 11	User 12	User 13	User 14	User 15	Pass %	Fail %
1) Login	P	P	P	F	P	P	P	F	P	P	80	20
2) Add Story	P	F	P	P	F	P	P	P	P	P	80	20
3) Leave comment	P	F	P	F	P	P	F	F	P	F	50	50
4) Send message	P	F	P	F	F	P	P	P	P	P	70	30
5) Read notification	F	F	P	F	F	P	P	P	F	P	50	50
6) Find nearby story	P	P	P	P	P	P	P	P	F	P	90	10
7) Find friend story	P	P	P	P	P	F	P	P	P	P	90	10

The last task for the control group was to play the “Welcome Story” to completion. This took them about 1 minute and 23 seconds on average. About half of the group navigated through the story smoothly. The other half was confused about the chapter and page maps. Most of the group was unsure what to do when they finished the story. It was unclear how to get back to their profile home page, and they often resorted to

Table 5.1: The amount of seconds it took participants (P) of the control group to complete their tasks.

User	Task 1	Task 2	Task 3
User 1	106	14	140
User 2	41	11	66
User 3	63	11	60
User 4	40	13	67
User 5	94	33	83
Average	68.8	16.4	83.2

clicking the PolyXpress “Home” button, which takes them out of the player app. One user had significant trouble navigating through the application, resulting in the 20% fail rate for the second and third tasks. The user needed a lot of guidance from the moderator to proceed with the tasks. The other users of the control group completed the tasks on their own with little guidance. However, all the tasks took longer to complete than the expected base line time as shown in Table 5.3.

The experimental group had more difficulty completing their tasks; none of the tasks had a 100% success rate as shown in Figure 5.4. Table 5.3 also shows that the experimental group took at least three times longer to complete the tasks than expected. Two experimental tasks in particular had failure rates of 50%. The users had difficulty completing Task 3 in a timely manner. This task required users to start the “Welcome Story”, navigate to a chapter, turn on the chapter discussion, and then leave a comment. While observing the users attempt this task, they seemed to have the most trouble navigating the UI to get from the chapter map view to the chapter overview. Once on the overview, they figured out how to leave a comment naturally. Since navigating the pages are similar to navigating the comments, the

Table 5.2: The amount of seconds it took participants (P) of the experimental group to complete their tasks.

User	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7
User 6	69	23	146	12	15	9	155
User 7	12	10	36	54	22	15	21
User 8	9	10	40	47	23	8	7
User 9	115	11	90	85	23	30	18
User 10	39	50	90	149	38	41	17
User 11	53	20	141	106	35	21	38
User 12	43	12	90	45	35	21	10
User 13	72	10	142	10	14	13	18
User 14	20	16	106	44	41	39	20
User 15	15	18	414	54	19	9	1
Average	44.7	18	129.5	60.6	26.5	20.6	30.5

Table 5.3: The average amount of seconds it took the groups for each task compared to the expected time per task.

	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7
Control Group	68.8	16.4	83.2	n/a	n/a	n/a	n/a
Expected	16	8	50	n/a	n/a	n/a	n/a
Experimental Group	44.7	18	129.5	60.6	26.5	20.6	30.5
Expected	16	8	40	35	14	4	2

users had more success with Task 4 at a rate of 70%. Task 5 required the users to read a notification and this task also had a 50% success rate. After completing Task

4, the users were on the page view and were required to navigate out of the story playback and click on the Notification tab. Most users had difficulty navigating out of the story playback. They often clicked on the wrong button or accidentally reloaded the app. Once they finally got back to the PolyXpress+ home page, they were able to easily click on the Notification tab to complete the task. The experimental group had little trouble using the Friends feed and Nearby feed; Tasks 6 and 7 both had a 90% success rate.

The data gathered from the story playback test is shown in Appendices E and G. To process this data, the responses were categorized into the following categories: “strongly disagree” for values 1 and 2, “disagree” for values 3 and 4, “neutral” for values 5 and 6, “agree” for values 7 and 8, and “strongly agree” for values 9 and 10. The percentage of “disagree”, “neutral”, and “agree” values for each statement of the questionnaire was calculated and displayed in Figures 5.5 and 5.6. For the sake of analysis, “strongly disagree” and “disagree” values were combined into one category, as were “agree” and “strongly agree” values.

In the control group, 100% of the users either agreed or strongly agreed that the user interface was easy to use. This contrasts greatly to the experimental group in which 40% disagreed with the statement, and 20% were indifferent. This shows that the changes made between PolyXpress and PolyXpress+ must have overly complicated the UI. 80% of the control group responded to Statement 1 positively, agreeing that they enjoyed the app, while 20% were neutral about their enjoyment. The experimental group responded with 70% of the group enjoying the app; however, the other 30% disagreed with the statement. Both groups agreed 100% that an easy-to-use user interface is essential to their satisfaction with the app. This is further reinforced by Statement 6 (“I would use the app as is.”) where 60% of the control group were in agreement, but only 20% of the experimental group agreed. This statement also produced the highest disagreement rate of the experimental group of 60%. Interestingly,

both groups showed a low amount of interest in authoring stories for PolyXpress. The control group agreed 40% and disagreed 40% that they would author stories. The experimental group only had a 20% agreement rate that they would author, while 50% disagreed with the statement.

To look more in depth into the social networking features of PolyXpress+, the control group rated statements about their interest in social features, and the experimental group rated statements about actually using these features. The control group responded with 80% agreement for Statements 8 and 9, which said the user would be interested in playing and discovering stories that their friends have played. The experimental group supported the control's group opinion with a 90% agreement to Statement 8 ("I would be interested in discovering stories that my friends have played or authored"). After experiencing these features in the app with the Friends and Nearby feeds, the experimental group was in 80% agreement with Statements 9-11. These statements say that the Friends and Nearby feed helped them discover stories that their friends have played and new stories to play.

Interacting with friends in the app by messaging at events and chapter discussions were also part of the questionnaire. The control group responded to Statement 12 ("I would be more likely to use the app if I could interact with my friends while using the app") as 40% neutral and 60% agreeing. When tested by the experimental group, messages from friends motivated 70% of the users to play the story, and 80% of the users enjoyed sending messages. 60% of the experimental group agreed that chapter discussions made the chapter more interesting, while 40% were neutral. This is surprising because it's the only specific feature related statement with no disagreement. When it came to Statement 15 ("I would be more likely to use the app if more of my friends used the app"), 90% of the experimental group agreed, leaving only 10% to disagree. Overall, 70% of the experimental group enjoyed using the social interactions with their friends throughout the app, while only 30% felt neutral about

it. Even though only 60% of the control group thought interacting with friends would make them use the app, the experimental group felt more strongly about interacting with friends in the app.

5.4 Findings and Recommendations

The results of the usability study indicate that the overall user experience of PolyXpress was not increased by the social networking features; however, these features are desired and liked by the users. As shown in the previous section, the enjoyment from using the app dropped from 80% with the control group to 70% with the experimental group, the understanding of the UI dropped from 100% satisfied to 40%, and the percentage of users that would use the app dropped from 60% to 20%. This shows that the changes made between PolyXpress and PolyXpress+ complicated the UI and made the app more difficult to use. The responses from the users suggest that PolyXpress would be more engaging with social features if the user interface was updated in a manner that better supports the features. One user said that the “menu was too deep... [and the app required] too much clicking.” Other users felt that the UI “felt dated and old,” and the buttons were confusing and inconsistent. Another point of confusion for users was the map interface. User feedback indicated that updating the map with standard map icons and more directions would provide a better experience.

When it came to the social features of PolyXpress+, the results were mostly positive. The chapter discussions only had a 60% success rate according to the survey, but the other 40% were neutral, not negative. From the debrief interview, many users responded that the chapter discussion functionality had potential to add depth to the stories. They thought that with more users in the app and with real content, the discussions could provide an interesting and engaging aspect. The responses to the

messaging statements showed that the users thought the messages were motivating and they enjoyed sending them. However, when reviewing the answers to the interview questions, it became clear that the messaging system was overall confusing to users and should be redesigned. The flow of sending a message did not prove to be very streamlined. One user described it as needing to be more automated and passive. The users were also confused as to why there were separate message threads at every page. Users felt the messages should be one continuous conversation between friends, regardless of their current page.

The Friends and Nearby feeds seemed to prove useful in helping users discover more stories. Users easily navigated to the feeds and understood how to use them. Some users wished for more features within the feeds to show “more context of friends interactions, [such as] did they like, finish, or comment [the story].” The notifications feature was also easily understood by users. The task to read a notification had a 50% failure rate, but that was because the users had difficulty navigating to the Notification tab from story playback. Once the users made it to the Notification tab, they could easily read their notifications. One user did suggest using real phone notifications. Real notifications would notify the user that they received a message even when they have the app closed. This would increase app engagement by encouraging users to open the app again.

Several users indicated that they would not use the app if there were no social interactions with friends in the app. Having more friends and more content seemed to be the key for getting users engaged in the app. Several users expressed that PolyXpress may be more engaging with real stories and content. However, the survey shows that most users were not interested in authoring stories. Finding authors to create good content could prove to be a challenge. One user suggested that PolyXpress take on some game-like features. Adding a competitive drive to the app may encourage users to author stories, as well as play them. They could be rewarded with authoring

badges or some other form of incentives, and could compete with friends or other users.

Figure 5.5: The compiled results for the control questionnaire.

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Disagree %	Neutral %	Agree %
1) I enjoyed using the PolyXpress Player app.			1		4	0	20	80
2) I thought the stories were more interesting.			1		4	0	20	80
3) Interesting stories are essential to my satisfaction with the PolyXpress Player.			1		4	0	20	80
4) I thought the user interface was easy to use.				3	2	0	0	100
5) An easy to use interface is essential to my satisfaction with the PolyXpress Player.				2	3	0	0	100
6) I would use the app as is.		1	1	2	1	20	20	60
7) I would author stories for the PolyXpress Platform.	2		1	1	1	40	20	40
8) I would be interested in discovering stories that my friends have played or authored.			1	1	3	0	20	80
9) I would be interested in playing stories that my friends have played or authored.			1	1	3	0	20	80
10) I would be more likely to use the app if more of my friends used the app.		1	2		2	20	40	40
11) I would be interested in discovering stories that have been played nearby my location.			3		2	0	60	40
12) I would be more likely to use the app if I could interact with my friends while using the app.			2	1	2	0	40	60
Totals	2	2	14	11	31	6.66667	23.333	70

Figure 5.6: The compiled results for the experimental questionnaire.

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Disagree %	Neutral %	Agree %
1) I enjoyed using the PolyXpress Player app.		3	0	5	2	30	0	70
2) I thought the stories were more interesting.		1	3		6	10	30	60
3) Interesting stories are essential to my satisfaction with the PolyXpress+ Player.	1			3	6	10	0	90
4) I thought the user interface was easy to use.		4	2	4		40	20	40
5) An easy to use interface is essential to my satisfaction with the PolyXpress+ Player.				2	8	0	0	100
6) I would use the app as is.	3	3	2	2		60	20	20
7) I would author stories for the PolyXpress Platform.	1	4	3		2	50	30	20
8) I would be interested in discovering stories that my friends have played or authored.		1		6	3	10	0	90
9) The friends feed helped me see what stories my friends were playing.	1		1	3	5	10	10	80
10) The nearby feed helped me discover new stories.		1	1	5	3	10	10	80
11) The friends feed helped me discover new stories.		1	1	5	3	10	10	80
12) The messages from my friends motivated me to play the story.		2	1	4	3	20	10	70
13) I enjoyed sending messages to my friends while playing the story.		1	1	5	3	10	10	80
14) The chapter discussions made the chapter more interesting.			4	4	2	0	40	60
15) I would be more likely to use the app if more of my friends used the app.		1	1	3	6	10	0	90
16) I enjoyed the social interactions with my friends throughout the app.			3	3	4	0	30	70
Totals	6	22	22	54	56	17.5	13.75	68.75

Chapter 6

RELATED WORK

Creating interactive stories and relating storytelling to locations are not new ideas on their own [16]. There have been many different attempts at this over the past couple decades. Several published works explore the idea of social networking and location-based storytelling. From as early as 1997, computer scientists have been researching the idea of using mobile devices for context-aware storytelling, such as with Cyberguide [5]. Cyberguide even included some pre-social-networks SNS features, such as communicating with other users and sharing location.

One such example can be seen in a paper titled “Location-based storytelling in the urban environment” [16]. In this example, they created a prototype system using a PDA and a headset to experience a story in an urban environment. They developed an interesting story-plot for users to experience. They planted real life props for the users to discover and use to progress the story, making the story truly interactive. Users responded well to the use of real life props, saying it made the story more engaging [16]. Although, while this project was about location-based storytelling, it lacked the social networking functionalities of PolyXpress+.

However, there are several other projects that share similar features to PolyXpress+. They all have aspects of mobility, social, and location-based storytelling features. One project, called MPISTE, is an environment for mobile devices to tell personalized stories based on the user’s physical location [9]. After its presentation, it was adapted to aid the severely motor-impaired visitors through museums [9]. Based on the user’s profile, the virtual guide tells the story depending on her emotional state [9]. The user is tracked by their framework that uses GPS, RFID, and Bluetooth to accomplish outside and inside tracking.

Another project titled iZone is a location-based mobile social network. The project introduces a prototype system with seven subsystems: Registration and Login Subsystem, Map Subsystem, Homepage Subsystem, Friend Subsystem, Mail Subsystem, Local Information Subsystem, and Setting Subsystem [7]. Each subsystem has specific social aspects that the user can interact with. For example, the map subsystem allows for users to perform local searches for local users, restaurants, businesses, etc [7]. PolyXpress+ shares a similar functionality in that users can view their friends' activity feeds to see nearby stories.

Another research project in the realm of HCI and location based stories is called "Riot!" Riot! is a story about the user experience of a "location-sensitive interactive play for voices" [6]. Taking place in Queen's Square in Bristol, England, users would walk around with a PDA and their movement would trigger sound files describing the historical context of a real riot that took place in 1831. Due to the radical interdisciplinary nature of the Riot! project, researchers found the user experience was based not only on the design decisions and implementation of the system, but also on the individual participants' backgrounds and dispositions [6]. This is similar to PolyXpress+ in that user satisfaction will mostly come from the creativity and content of the stories that users experience.

Chapter 7

CONCLUSION

The work carried out in this thesis aimed to increase the user engagement of the original PolyXpress Player by adding new social networking features. Using Facebook to login to PolyXpress+, users were granted the ability to interact with their Facebook friends in the following ways: commenting on public discussion threads within chapter summaries, messaging friends at pages while playing a story, checking message notifications, viewing their friends' PolyXpress+ activity with the Friends feed, and discovering new stories with the Global feed. These features are similar to those found amongst many popular social networking apps today.

A usability study was conducted to analyze the engagement of the app with the social networking additions. The control group used the original PolyXpress app, while the experimental group used the PolyXpress+ app. Both groups performed a number of click-through tasks and a complete story walk-through, after which followed a Likhart scale based questionnaire and several debrief interview questions. The results of the tasks, questionnaire, and interview responses were analyzed and compiled.

Although most of the experimental group enjoyed the social features of PolyXpress+, and the control group desired social networking features in PolyXpress, the user engagement of PolyXpress+ was not increased by the new features. The experimental group reported that PolyXpress+ was not very user friendly and satisfaction with the app decreased compared to the control group's satisfaction with PolyXpress. Overall, both groups enjoyed playing the stories and were partial to the idea of a more polished version of the app. Since many users stated they would only use the app if it contained social features, the next steps for PolyXpress should be to update the

user interface to support the social features properly. Once the UI issues have been addressed and social features updated, it would be prudent to do another usability study on the new version of the PolyXpress+ app.

7.1 Future Work

There are many features and improvements that would benefit the PolyXpress+ Player and would help reach the goal of increasing the user engagement. Several of these features were given by the test users during the debrief interview (results shown in Appendices H and I), and will be highlighted here.

The most major improvement is to rewrite PolyXpress+ as a native application. A native application would run a lot smoother and would be able to handle the more complicated user interface in a natural manner. For instance, notifications would be more effective by having the app send push-notifications to the user's phone once they received a message. Currently users have to open the app in a mobile web browser, and go to the notification view in order for the view to refresh and display any new messages. However, if rewriting PolyXpress+ as a native app is not feasible, an alternative solution for notifications could be to send an email or text message to the user every time they have a new message as a form of notification. That way, the user is actually notified to check their PolyXpress+ notifications.

With PolyXpress+ no longer a web-app, the chapter and page maps can also be redesigned to solve the issues that the testers experienced. During the story-playback phase of testing, many users did not want to keep the web app open while walking from one chapter or page to the next. It's common practice to turn off the phone's screen while its not in direct use. If PolyXpress+ was a native app, the app could notify the user when they are in range of a new chapter or page. Once notified, the user could simply open the app, the map would quickly refresh on screen, and then

the user could view the new chapter or page. Another improvement to the map views that several testers asked about was to have turn-by-turn navigations to get to one chapter or page to the next. This feature would be cleaner to implement natively.

PolyXpress+ messages has the potential to be very engaging for users once the feature is redesigned in a more streamlined fashion. Currently, users have to click a lot of buttons to send a message to a friend. Some user feedback suggested that messaging be more passive for the users. The messaging user interface should be updated to a more widely accepted design. Also, the design of the messaging feature needs to be reworked. If User A messages User B at Page 1, and then messages User B again at Page 2, two separate conversations are created: one at Page 1 and one at Page 2. The usability testers thought this was a confusing approach to messages and thought a single conversation should exist between two users.

User feedback indicated that the Friends and Nearby feeds were helpful, but could be even better with added functionality. It was requested that the feed items give more context of the user's activity, such as whether they liked the story, whether they would recommend the story, and the length of time that the story took. The ability to express emotions for feeds and stories, such as Facebook's liking feature, was also desired.

One last feature that could really help improve PolyXpress+'s user engagement is gamification. By creating a competitive drive in the app, users will want use the app more often to compete with their friends and other users. According to an internal study by Gigya, gamification can increase a website's online commenting by 13%, social media sharing by 22%, and content discovery by 68% [13]. Users could be rewarded for playing and for authoring stories. This could also help increase the desire to author stories, an improvement that is needed since the questionnaire showed that the majority of users would not author stories with the current app.

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APPENDICES

Appendix A

BACKGROUND QUESTIONNAIRE FORM

This appendix contains screenshots of the forms and surveys that were used during the assessment phase of PolyXpress. The forms were originally hosted on Google Forms and distributed online to the test participants.

Background Questionnaire

* Required

Name *

Your answer

Age *

Your answer

Are you a Facebook user? *

☐ Yes

☐ No

Do you have a smartphone? *

☐ Yes

☐ No

NEXT

Background Questionnaire

Phone Info

What type of phone do you use?

☐ Android

☐ iPhone

☐ Other: _____

What mobile web browser do you use?

☐ Chrome

☐ Safari

☐ Other: _____

BACK

NEXT

Background Questionnaire

* Required

Agree & Consent

I agree to participate in the study conducted by Desiree Creel for the PolyXpress project.

I understand that participation in this usability study is voluntary and I agree to immediately raise any concerns or areas of discomfort during the session with the study administrator.

I understand that I can read the privacy policy at <https://github.com/dcreel121/polyxpress-plus/blob/master/PolyXpress/PRIVACY.md> to find more information about how the data from this study will be used.

I understand that my actions may be recorded for analysis of the PolyXpress project.

Please initial and date below to indicate that you have read and you understand the information on this form and that any questions you might have about the session have been answered.

Date *

Date

mm/dd/yyyy

Initial to consent *

Your answer

BACK

SUBMIT

Appendix B

CONTROL CLICK-THROUGH TASK LIST

This is the click-through task list given to the control group. It contains tasks for the PolyXpress app that has no social features.

Tasks

1. Login to the PolyXpress Player with the following URL in a mobile web browser or scan the QR code:

<https://polyxpress.cfapps.io/PolyXpress/Player/pePlayer.html>



2. Add the “Welcome” story from the store to your reading list.
3. Play through the “Welcome” story.

Appendix C

EXPERIMENTAL CLICK-THROUGH TASK LIST

This is the click-through task list given to the experimental group. It contains tasks that involve the PolyXpress+ app and the social features of the app.

Tasks

1. Login to the PolyXpress+ Player with the following URL in a mobile web browser or scan the QR code:

<https://pxplus.cfapps.io/PolyXpress/Player/pePlayer.html>



2. Add the “Welcome” story from the store to your reading list.
3. Play the “Welcome” story and leave a comment in a chapter.
4. Send a message to a friend while viewing the “Welcome” story.
5. Read a PolyXpress+ notification.
6. Find a story that’s located nearby.
7. Find a story that a friend has played.

Appendix D

ASSESSMENT QUESTIONNAIRE FOR CONTROL GROUP

This section of the appendix contains screenshots of the PolyXpress Questionnaire. Test participants from the control group were required to complete the survey after their trial run with PolyXpress.

PolyXpress Questionnaire

On a scale from 1 (least accurate) to 10 (most accurate), how would you rate the following statements

1) I enjoyed using the PolyXpress Player app.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

2) I thought the stories were more interesting.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

3) Interesting stories are essential to my satisfaction with the PolyXpress Player.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

4) I thought the user interface was easy to use.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

5) An easy to use interface is essential to my satisfaction with the PolyXpress+ Player.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

6) I would use the app as is.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

7) I would author stories for the PolyXpress Platform.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

8) I would be interested in discovering stories that my friends have played or authored.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

9) I would be interested in playing stories that my friends have played or authored.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

10) I would be more likely to use the app if more of my friends used the app.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

11) I would be interested in discovering stories that have been played nearby my location.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

12) I would be more likely to use the app if I could interact with my friends while using the app.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

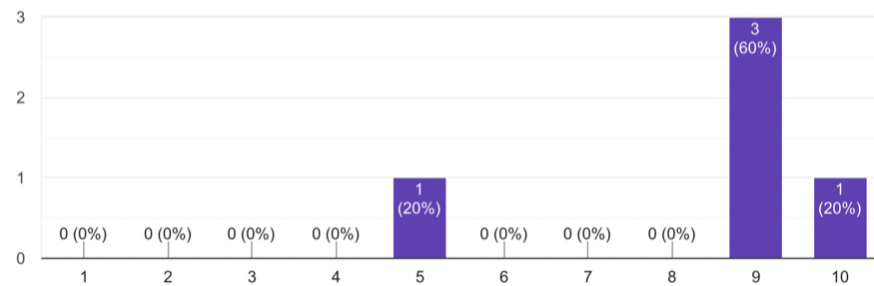
SUBMIT

Appendix E

CONTROL GROUP QUESTIONNAIRE RESULTS

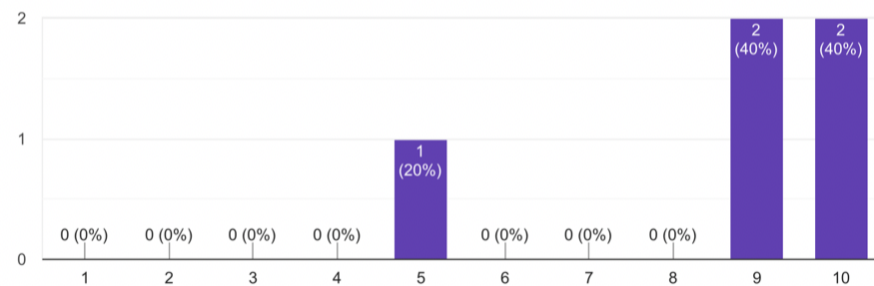
1) I enjoyed using the PolyXpress Player app.

5 responses



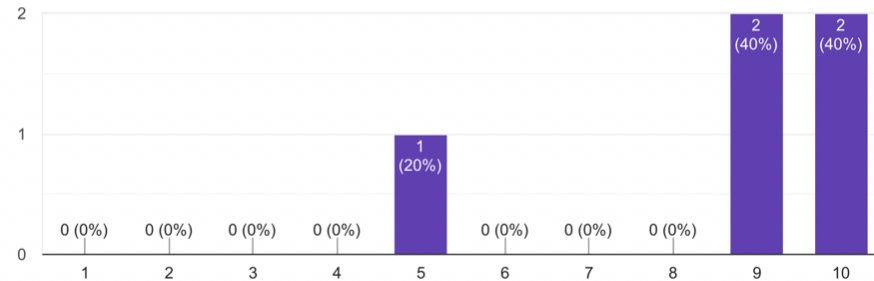
2) I thought the stories were more interesting.

5 responses



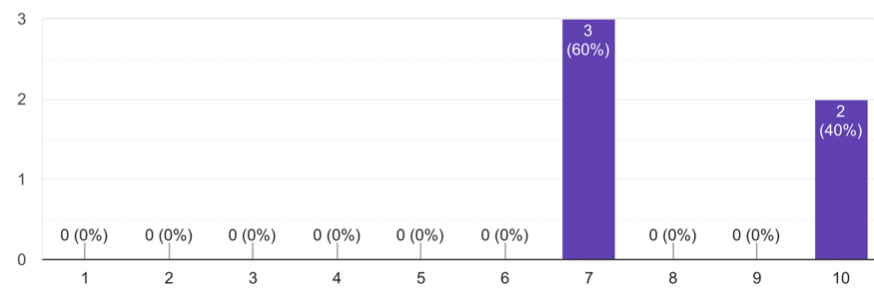
3) Interesting stories are essential to my satisfaction with the PolyXpress Player.

5 responses



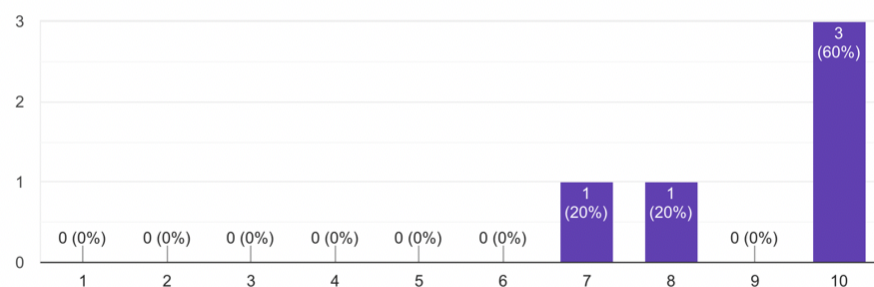
4) I thought the user interface was easy to use.

5 responses



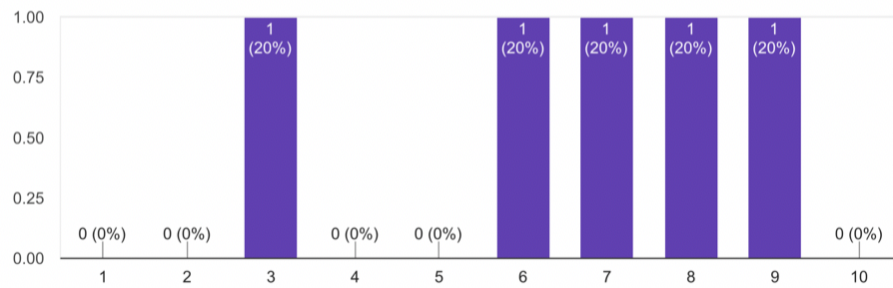
5) An easy to use interface is essential to my satisfaction with the PolyXpress+ Player.

5 responses



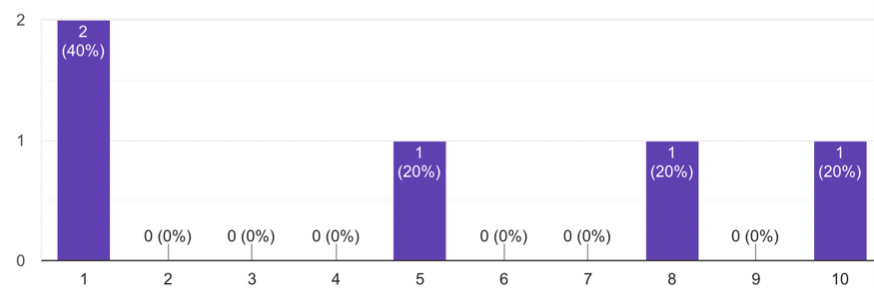
6) I would use the app as is.

5 responses



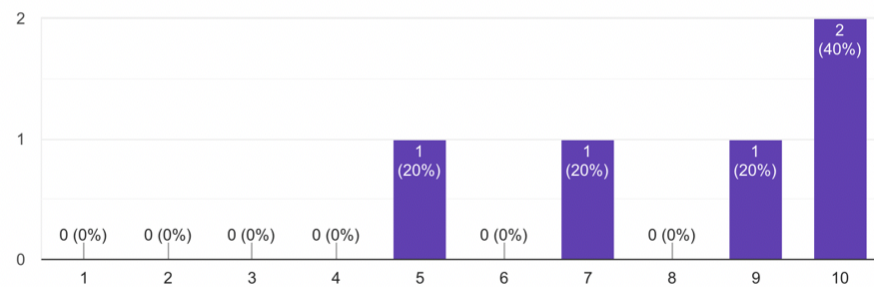
7) I would author stories for the PolyXpress Platform.

5 responses



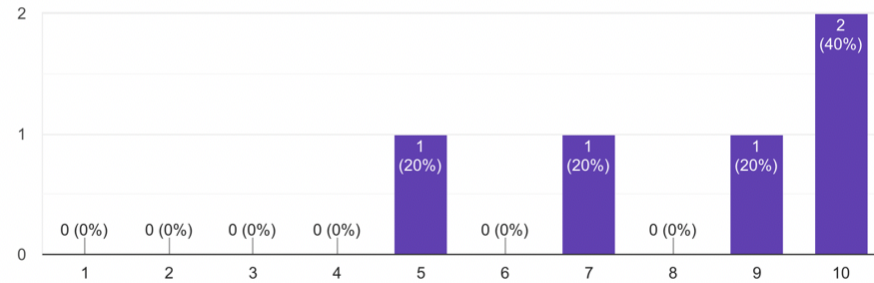
8) I would be interested in discovering stories that my friends have played or authored.

5 responses



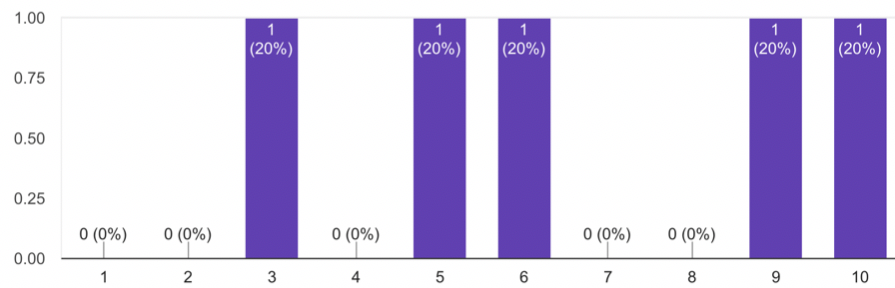
9) I would be interested in playing stories that my friends have played or authored.

5 responses



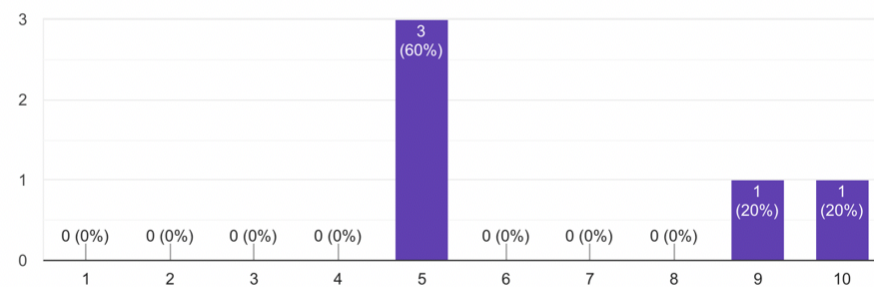
10) I would be more likely to use the app if more of my friends used the app.

5 responses



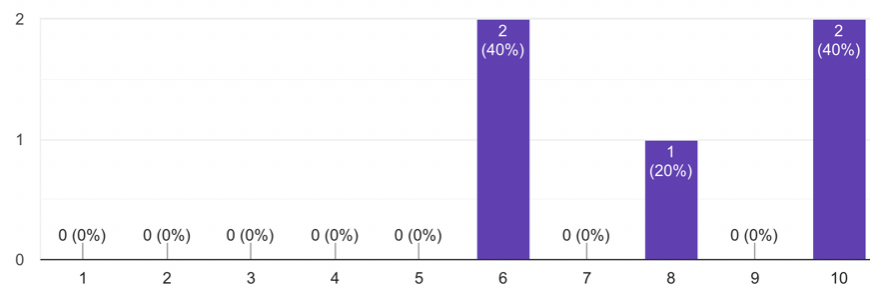
11) I would be interested in discovering stories that have been played nearby my location.

5 responses



12) I would be more likely to use the app if I could interact with my friends while using the app.

5 responses



Appendix F

ASSESSMENT QUESTIONNAIRE FOR EXPERIMENTAL GROUP

This section of the appendix contains screenshots of the PolyXpress+ Questionnaire. Test participants from the experimental group were required to complete the survey after their trial run with PolyXpress+.

PolyXpress+ Questionnaire

On a scale from 1 (least accurate) to 10 (most accurate), how would you rate the following statements?

1) I enjoyed using the PolyXpress+ Player app.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

2) I thought the stories were interesting.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

3) Interesting stories are essential to my satisfaction with the PolyXpress+ Player.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

4) I thought the user interface was easy to use.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

5) An easy to use interface is essential to my satisfaction with the PolyXpress+ Player.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

6) I would use the app as is.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

7) I would author stories for the PolyXpress+ Platform.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

8) I would be interested in playing stories that my friends have played or authored.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

9) The friends feed helped me see what stories my friends were playing.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

10) The nearby feed helped me discover new stories.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

11) The friends feed helped me discover new stories.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

12) The messages from my friends motivated me to play the story.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

13) I enjoyed sending messages to my friends while playing the story.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

14) The chapter discussions made the chapter more interesting.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

15) I would be more likely to use the app if more of my friends used the app.

1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

16) I enjoyed the social interactions with my friends throughout the app.

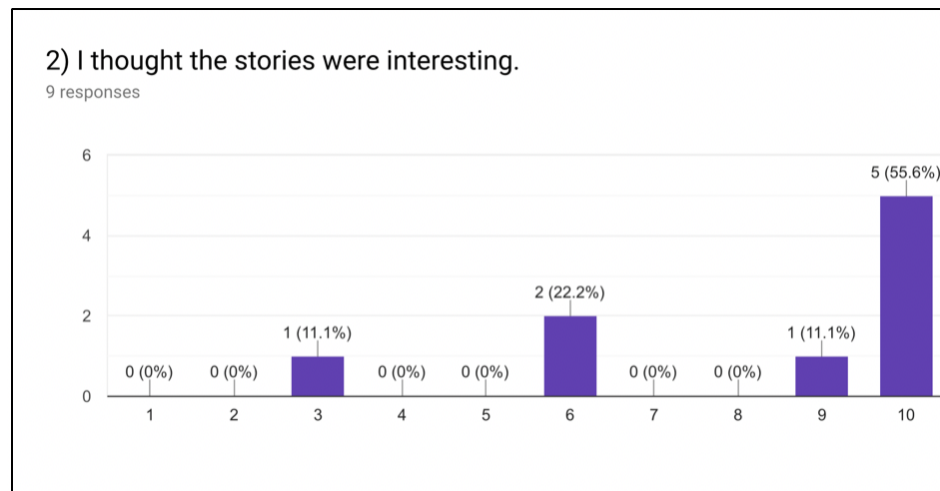
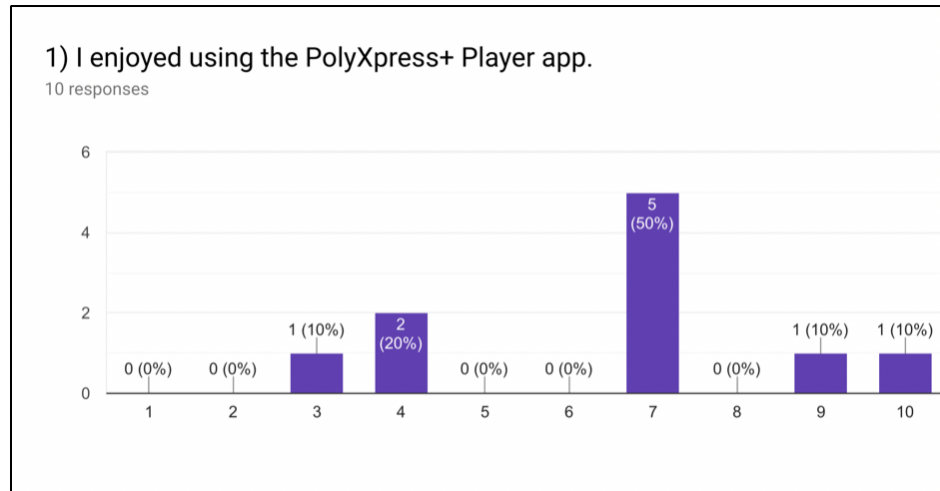
1 2 3 4 5 6 7 8 9 10

least accurate ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ most accurate

SUBMIT

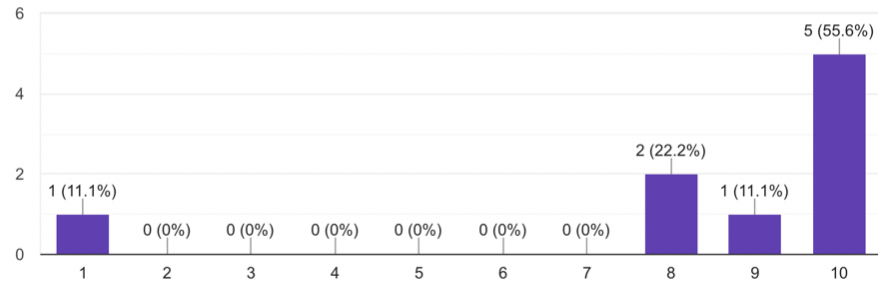
Appendix G

EXPERIMENTAL GROUP QUESTIONNAIRE RESULTS



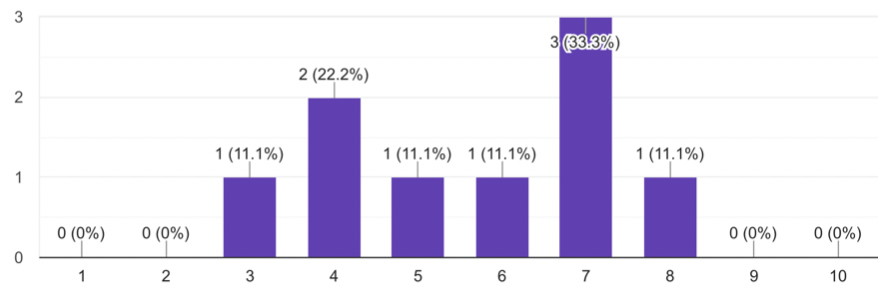
3) Interesting stories are essential to my satisfaction with the PolyXpress+ Player.

9 responses



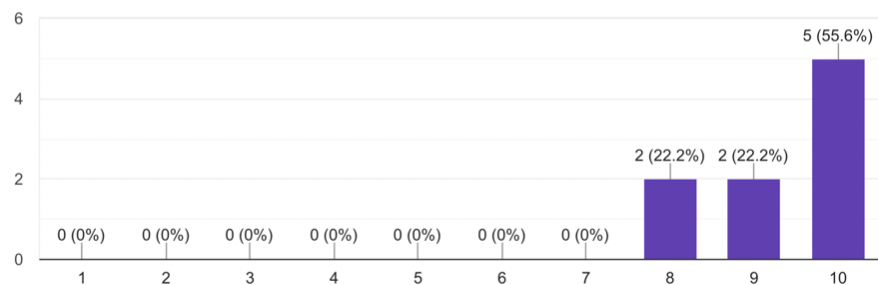
4) I thought the user interface was easy to use.

9 responses



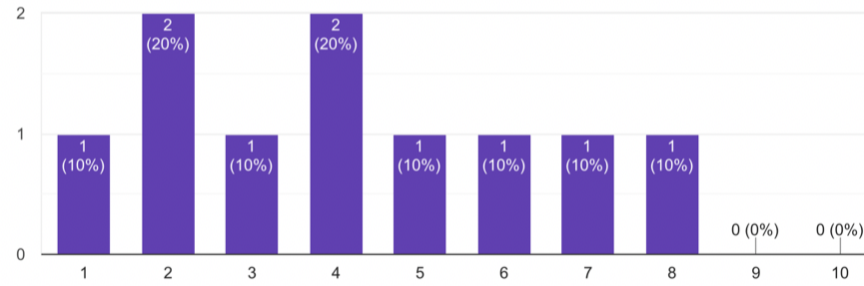
5) An easy to use interface is essential to my satisfaction with the PolyXpress+ Player.

9 responses



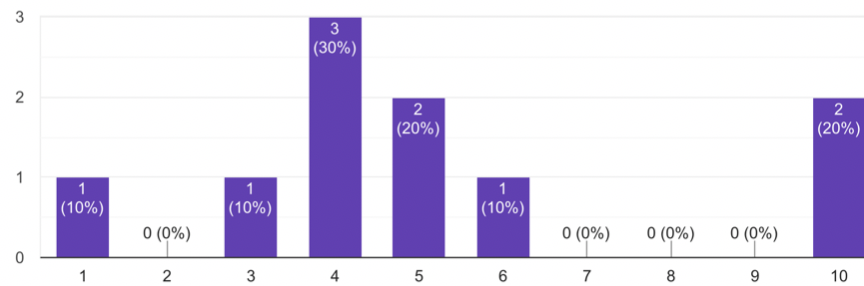
6) I would use the app as is.

10 responses



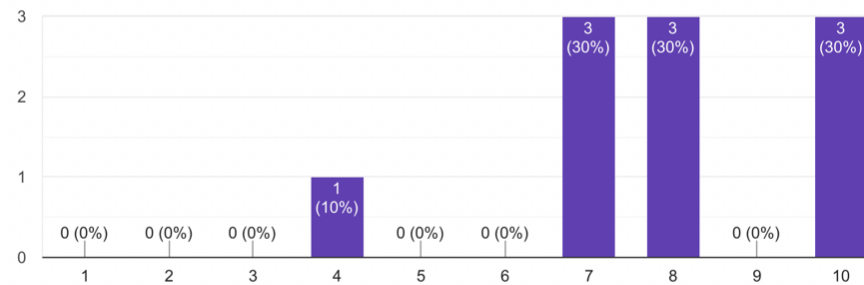
7) I would author stories for the PolyXpress+ Platform.

10 responses



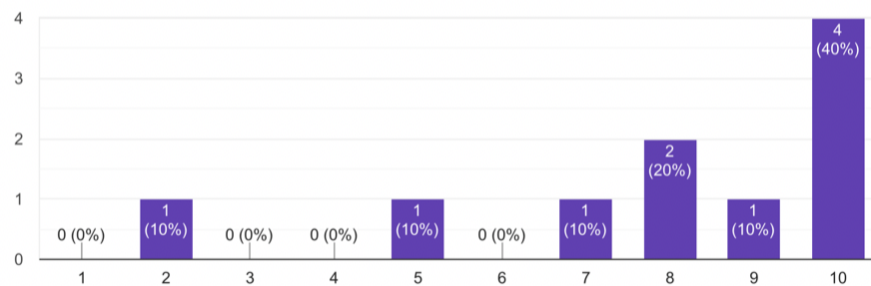
8) I would be interested in playing stories that my friends have played or authored.

10 responses



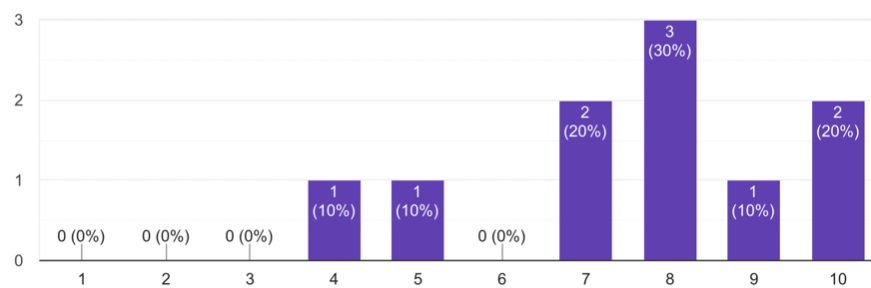
9) The friends feed helped me see what stories my friends were playing.

10 responses



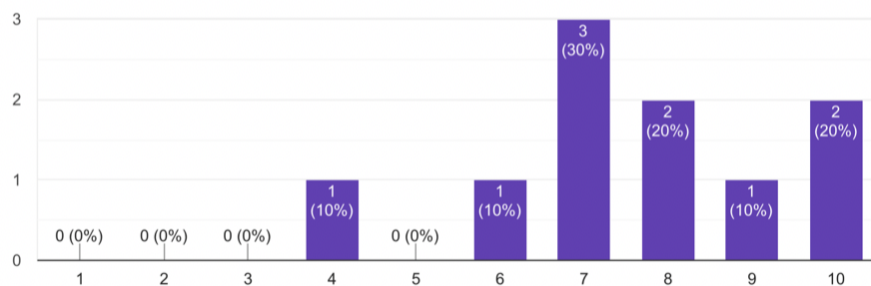
10) The nearby feed helped me discover new stories.

10 responses



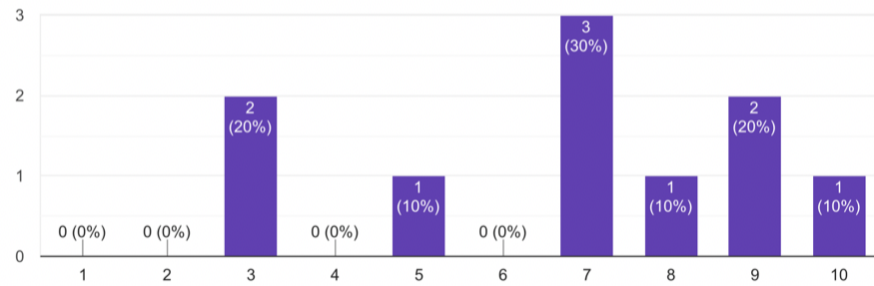
11) The friends feed helped me discover new stories.

10 responses



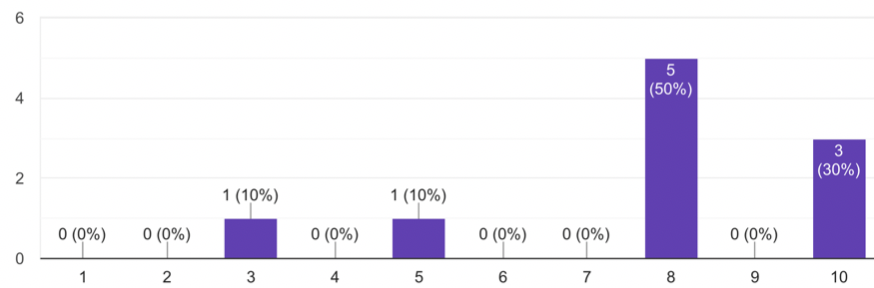
12) The messages from my friends motivated me to play the story.

10 responses



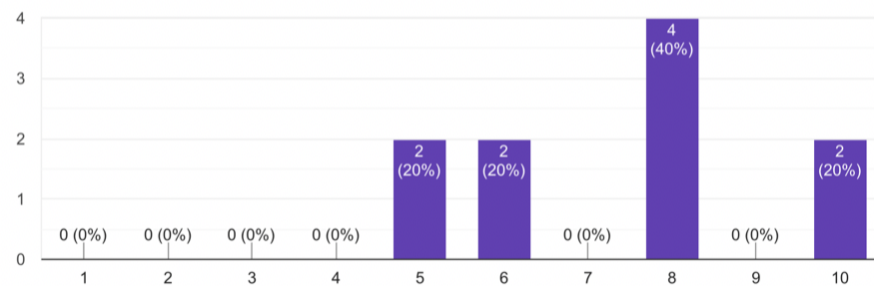
13) I enjoyed sending messages to my friends while playing the story.

10 responses



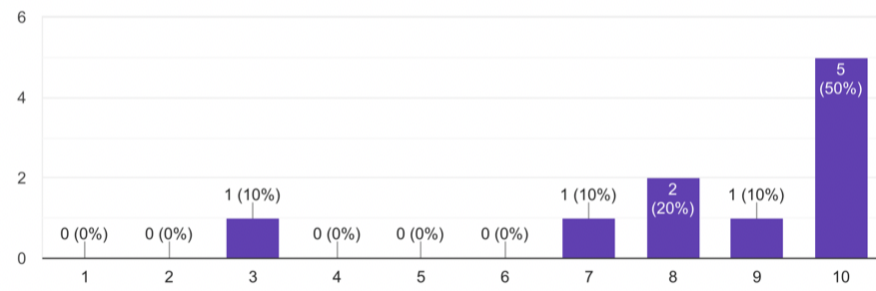
14) The chapter discussions made the chapter more interesting.

10 responses



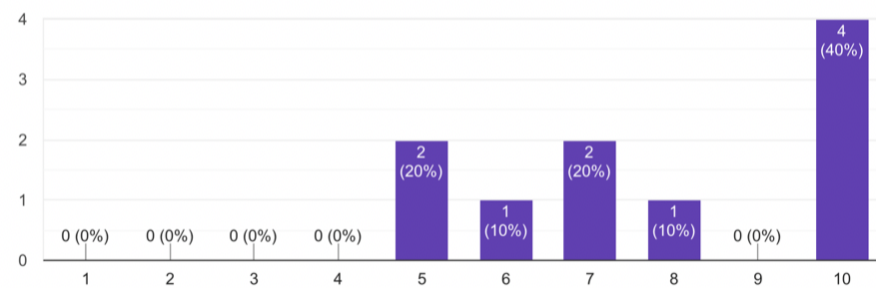
15) I would be more likely to use the app if more of my friends used the app.

10 responses



16) I enjoyed the social interactions with my friends throughout the app.

10 responses



Appendix H

DEBRIEF QUESTIONS AND RESPONSES FOR CONTROL GROUP

The following questions were given to the control group as a debrief to the testing.

1. Please describe your overall reactions after using the PolyXpress app.
2. Do you feel like social interactions throughout the app would be beneficial?
3. Would social interactions make playing the story more engaging?
4. What would make the app engaging and fun?

Here are the notes recorded during the interviews. They contain the test user's responses to the questions above:

User 1

1. It was fun and got me outside walking and relaxing.
2. Yes, if friends could leave comments.
3. Yes, it would make it more interesting.
4. If you could see what your friends were reading, what they thought, how fast they walked it.

User 2

1. Entertained, good way to learn while being outside, interface was simple
2. Yes, finding a way to make it a group activity, give people different tasks.
3. Yes, more people equals more fun

4. Social aspect

User 3

1. Liked it, unique app, quite enjoyable and fun. UI is confusing. Pages need organizing. Within the same view want to know the story/chapter/page within a glance and where I'm at relative to it. Hierarchy at a glance. Being able to switch between chapters. Not sure if its sequential or not.
2. Yeah, especially in group set up.
3. Yeah if friends could play together, if it was more like a game like a treasure hunt
4. Having badges to make it a competition, winners, group setting.

User 4

1. It was an okay app, would probably only use it if someone asked me to use it. Kinda like Pokemon go meets story. Rather sit to read story. Hard to read and walk maybe dangerous. UI fine, after the first chapter. Easy to navigate.
2. Yeah, if you got to a part and everyone was like "omg." If everyone was doing it at the same time, Facebook live.
3. Maybe if there was a social mode and could turn it off. Sometimes could be distracting.
4. Better content, stories. Better authors.

User 5

1. Needs to be more direct, UI was confusing. Too many buttons to click when navigating.

2. Yes, human interaction is good
3. Yes, would like to talk to someone about it.
4. Likes, emojis. Put emotion on it.

Appendix I

DEBRIEF QUESTIONS AND RESPONSES FOR EXPERIMENTAL GROUP

The following questions were given to the experimental group as a debrief to the testing.

1. Please describe your overall reactions after using the PolyXpress app.
2. Do you feel like the social interactions throughout the app were beneficial?
3. Did the social aspects make playing the story more engaging?
4. What would make the app engaging and fun?

Here are the notes recorded during the interviews that contain the test user's responses to the questions above:

User 6

1. It was amusing. Liked the idea behind it, but seems like it still needs work.
2. Yes, if you are going through stories with your friends you can elaborate more on the story and build more of a connection. Something you can do with your friends that's not going to get you into trouble.
3. Yes, it gives the story more depth. You can talk to others and its focused on the story. Instead of random MEMEs like your Facebook feed.
4. Some things weren't that easy to find. Improve the accuracy of the location within the chapters/pages. UX was straight forward once started tapping on things. Map design needs updates.

User 7

1. Liked the stories, frustrated couldn't send messages, no error feedback. Liked that stories were based on ranged, liked the hints.
2. Yes, if they worked.
3. It was more engaging. If there weren't others playing I wouldn't want to respond.
4. Nicer user interface. Relatable stories were good. Would be interesting with more stories

User 8

1. It's a cool idea. Some of the dialogs needed better sizing for text getting cut off. Messages were confusing. Maybe more instruction could have helped. If it was more automated. More of a passive user off the bat. Menu was too deep. Too much clicking to get back to the home. NO instruction as to how it worked to get home.
2. Yeah, social made the app in these context. If trying to learn on my own I would maybe do it without social. How did get the app.
3. Yeah, I wouldn't do it if no one knew I did it. Very vain.
4. Having a path to follow instead of spots would be nice. Not sure if linear experience or random adventure. Real notifications, don't want the phone to be open while playing. Real app. Didn't know what I was supposed to do at the spot. Maybe social aspect is detracting from story itself. Wanted to just go to see what Sean said, didn't really care about story itself.

User 9

1. It was very rudimentary. The core of it worked. It could be interesting. Would have trouble getting people to make stories. Hard to get content at first. UX bad, ugly, fat. Functionality was weird. Skeleton.
2. Social interactions did not seem beneficial. Since it was test data.
3. Yeah,
4. Stronger content, better stories.

User 10

1. Dated interface. Difficult to use and navigate even with the instructions. Issues with loading things that prevented streamlined experience. Enjoyed stories random facts, made it fun. Four square with trivia. Notifications was clear, but nearby could have used more info, could be more clickable more things could show up. Bugs with messaging.
2. Not beneficial but more interesting. More likely that id use it.
3. Without the comments it there would be no reason to use the app. Social component is important for repeat use.
4. Checking in would be cool, collect points. Even more social interactions, 2nd visitor of the place. Like chapters or pages since its on other social platforms.

User 11

1. Difficult interface and dated. Didn't fully see the benefit of the location services. Areas were kinda broad, needed a bigger story maybe. If friend was traveling. Going from chapter to page was confusing, chronologically was confusing, was it linear. Needs to be more simple. Too many buttons make it feels old.

2. Discover piece could be interesting with more content. Limited friends and stories were limiting,
3. Not yet, need more volume of comments to make it matter.
4. Labeling of the stories could help. The purpose of the story itself was confusing.

User 12

1. Thought it was okay. Feels dated. Tough to use in the beginning.. After the welcome story helped a little. Continue button was confusing. If it was easier to find. Side panel is weird. During welcome story, would be good if chapters/pages auto zoomed location when started.
2. Notification badges could have been useful
3. The nearby and friends stories were helpful for discovering. The discussion needs more to judge it fully (if there were more people)
4. Being a consumer is possible but how to get contributors is the hard part.

User 13

1. The Facebook photo didn't load. PolyXpress home button is confusing; should be an exit button. The store should be a library since no paying is necessary. Back button is not consistent, move page specific if messaging no sense. Conversation should be linear not all over. UI button comment/message not different enough. Not clear that ones private and one is public. Messages should pop up mid. Messages felt like detracted from the story.
2. Comments maybe. Message no. UX needs lots of work. Friends feed too titles maybe if friends confusing.

3. Maybe if more social friends were there. If Friends feed had more features like looking at comments
4. Single message thread. Messages –i hints. Messages –i media based. More context of friends interactions, did they like, finish, or comment?

User 14

1. Enjoyed going to the place that were highlight on the map because it usually worked when it popped up. Liked Stelly's comments. Confused where to click once in the location button. A pop-up in bold or something would help. UX flow, going from pages back to chapters. Needed more direction getting from one part to the next.
2. Sometimes social interactions were available, sometimes it wasn't. (message bug) Comments were cool to leave author responses.
3. Yes. Would be better with more people using the app and commenting.
4. Turn by turn directions.

User 15

1. Thought it was cool. Would be cool if it had more direction on the app for next step in th story. UX felt intuitive, prompting helped when GPS wasn't working well.
2. Similar to Alex. Could be interested in story because of friends comments. Crucial part of app.
3. Yeah, wouldn't write stories unless there were comments. Comments make it worth while.

4. If it would integrate with Google maps (direction wise) see more local business and pictures.